









SMITHSONIAN INSTITUTION  
UNITED STATES NATIONAL MUSEUM

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# PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

VOLUME 85



15250



IARI

UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON: 1940

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The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

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ALEXANDER WETMORE,

*Assistant Secretary, Smithsonian Institution.*

WASHINGTON, D. C., February 12, 1940.

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SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1937

No. 3027

# ON SOME ONYCHOPHORES FROM THE WEST INDIES AND CENTRAL AMERICA

By AUSTIN H. CLARK

DR. EDWARD A. CHAPIN, curator of insects, United States National Museum, has been so kind as to submit to me for study a small but interesting collection of onychophores from the West Indies and Central America. It includes nine specimens of *Peripatus juliformis danicus* from St. Croix, two specimens of *Epiperipatus barbouri* from Tobago, two specimens of *Epiperipatus biolleyi* from Costa Rica, and a single specimen of a new species of *Macroperipatus* from Haiti.

The discovery of a species of *Macroperipatus* on the island of Haiti is especially interesting, as this genus was known heretofore only from Central and South America, ranging from Veracruz in Mexico southward to Rio de Janeiro in Brazil, including the island of Trinidad.

Five other onychophores are known from Haiti, all of which were recorded and described by Prof. Charles T. Brues from specimens collected by Drs. William M. Mann and P. J. Darlington. These five forms are *Peripatus manni*, related to the South American *P. sedgwicki*, and four subspecies of the purely West Indian *Peripatus dominicae*: *P. d. haitiensis*, *P. d. lachauxensis*, *P. d. basilensis*, and *P. d. darlingtoni*. Other subspecies of *Peripatus dominicae* occur on Dominica (*P. d. dominicae*), on Antigua and Montserrat (*P. d. antiguensis*), and on Puerto Rico and Vieques (*P. d. juanensis*).

In Haiti the four subspecies of *Peripatus dominicae* occupy localized and ecologically isolated habitats; *Peripatus manni* occurs with *Peripatus dominicae haitiensis*.

It is rather curious that, although two genera including six species and subspecies occur in Haiti, two genera including two species are found in Jamaica, and one genus with one species is known from Puerto Rico, no onychophores have ever been discovered in Cuba.

### Genus PERIPATUS Guilding

#### PERIPATUS JULIFORMIS DANICUS Bouvier

*Peripatus juliformis* var. *danicus* BOUVIER, Quart. Journ. Micr. Sci., vol. 43, pp. 751-752, 1900; Ann. Sci. Nat., ser. 9, vol. 2, nos. 4-6, p. 245, pl. 7, fig. 52, 1905 (Jan. 1906).

*Peripatus danicus* A. H. CLARK, Proc. Biol. Soc. Washington, vol. 26, p. 17, 1913.

*Locality*.—Prosperity Garden, St. Croix, Virgin Islands; from rotting stump of a mammea tree; H. A. Beatty. Five females and four males.

*Notes*.—The largest female is 45 mm long and 4 mm broad, with 31 pairs of legs; another is 42 mm long and 4 mm broad, with 32 pairs of legs; a third is 40 mm long and 3.5 mm broad, with 31 pairs of legs; the fourth is 35 mm long and 3 mm broad, with 32 pairs of legs; and the fifth is 30 mm long and 2.7 mm broad, with 32 pairs of legs.

The males are as follows: 16 mm long and 2 mm broad, with 26 pairs of legs; 15 mm long and 2 mm broad, with 27 pairs of legs; 15 mm long and 2 mm broad, with 27 pairs of legs; and 9 mm long and 2 mm broad, with 27 pairs of legs.

*Remarks*.—This species was first recorded from St. Croix by Prof Charles T. Brues in 1925 from specimens found under a rotten log by Dr. Frank E. Lutz.

### Genus EPIPERIPATUS A. H. Clark

#### EPIPERIPATUS BARBOURI (Brues)

*Peripatus barbouri* BRUES, Bull. Mus. Comp. Zool., vol. 54, no. 8, p. 310, figs. 1, 2, pl. 1, 1911.

*Locality*.—Scarborough, Tobago; Allison V. Armour Expedition; H. F. Loomis, February 19, 1932. Two females.

*Notes*.—One of the specimens is 38 mm long and 3.7 mm broad, with 34 pairs of legs; the other is 22 mm long and 4 mm broad with 31 pairs of legs. Both specimens as preserved are light yellow-brown, lighter beneath, and unmarked. The color in life was not recorded.

*Remarks*.—This species was known heretofore only from the neighboring island of Grenada. It appears to be quite different from the form that I recorded from Tobago in 1913 under the name of *Peripatus* (*Epiperipatus*) *trinidadensis*, but it is possible that some, at least, of these differences may be due to the poor condition of the specimen on which that record was based.

## EPIPERIPATUS BIOLLEYI (Bouvier)

*Peripatus biolleyi* BOUVIER, Bull. Soc. Ent. France, 1902, p. 258.—BOUVIER, Ann. Sci. Nat., ser. 9, vol. 2, nos. 4-6, p. 321, figs. 115-118, pl. 10, fig. 85, 1905 (Jan. 1906).

*Epiperipatus biolleyi* A. H. CLARK, Proc. Biol. Soc., Washington, vol. 26, p. 18, 1913.

*Localities*.—Parismina, Costa Rica; M. Valerio, July 26, 1928. Under the loose bark of old tree trunks. One female.

La Caja, San José, Costa Rica; M. Valerio, 1913. One female.

*Notes*.—The specimen from Parismina is 55 mm long and 6 mm broad and has 31 pairs of legs. The specimen from San José is 45 mm long and 5 mm broad and has 29 pairs of legs.

## Genus MACROPERIPATUS A. H. Clark

## MACROPERIPATUS INSULARIS, new species

*Locality*.—Between Jacmel and Tronin, Haiti; Dr. O. F. Cook. April 11, 1926. One female, the type (U. S. N. M. no. 1275).

*Description*.—The type and only specimen is a female 55 mm long, 4.5 mm broad, and 2 mm high, with 30 pairs of legs.

The dorsal plications are very regular, all of the same width. The principal papillae are subequal, on squarish or oblong bases that rise into a broad and very low cone surmounted by a high and prominent truncated cone or slightly tapering cylinder. The large papillae are commonly separated by one or two less developed papillae that often lack the terminal cone, rising from narrow bases. On the dorsal surface between the legs of each pair there are two intercalated partial plications, giving rise to a slight irregularity. The two plications over the middle of each leg tend to divide, more or less irregularly, just above the leg, there forming three or four short, irregular, incomplete plications. The midline of the dorsal surface does not differ from the remainder, except that here the bases of the papillae are narrower.

The legs of the fourth and fifth pairs bear four arcs with fragments of a fifth. The urinary tubercle rather strongly depresses the fourth arc, and appears to be independent of the third.

The salivary glands extend to the vicinity of the genital orifice.

The color in alcohol is uniform yellow-brown, lighter beneath. The color in life was not recorded.

*Affinities*.—This new species appears to be rather closely related *Macroperipatus perrieri* (Bouvier) from Veracruz, Mexico. The type and only known female of that species is 51 mm long and has 32 pairs of legs.





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SMITHSONIAN INSTITUTION  
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Vol. 85

Washington: 1937

No. 3028

SYNOPSIS OF THE BEETLES OF THE CHILEAN GENUS  
*PHYTHOLAEMA* (SCARABAEIDAE: MELOLONTHINAE)

By LAWRENCE W. SAYLOR

THE described species of the peculiar genus *Phytholaema*, which have more the general facies of rutelinids than of melolonthids, are known only from Chilean regions. The literature is somewhat scattered and much of it is entirely inaccessible to the average student; thus it is felt that the present synopsis will be of use. The genitalia have not been figured before, and as they possess good specific differences they are made use of herein.

Of the published data, probably the most complete is that of Germain, in which he discusses the relationships of the three species and also figures the mouth parts and antennae of *P. mutabilis*. The characters of the mouth parts are not used in the scarabs quite so generally as was formerly the custom, because it has been found that they are not entirely without variation, and though they often show good tribal, generic, or specific characters, such is not invariably the case.

Arrow in 1903 published notes on the relationships of this genus and *Modialis* Fairmaire and Germain, both from Chile, with two genera from Australia and New Zealand; these all have a superficial rutelinid appearance in the prominent front coxae, in the distinct and emarginate labrum, and in the ligula fused with the mentum.

The genus is of some economic importance, and *P. herrmanni*, at least, may at times do considerable damage to agricultural crops.

According to the habits of this species, as described by M. J. Rivera, the group must be somewhat similar to our American genus *Pleocoma* LeConte in that the larvae of the former show up in the ground in December, pass into the pupal stage around August, and emerge as adults during the latter part of September or early in October. The adult males emerge a few minutes after sunset and fly low over the ground until coming upon a female either beside or in the mouth of her burrow, whereupon the two copulate and retire immediately into her quarters; those males that do not meet with mates within half an hour or so after the flight begins retire into the first hole they find and remain there until the following day at the same hour. The evening flight is announced by a sudden loud humming from the wings of many males, and half an hour later the insects as suddenly disappear. The adults take no food, but soon after reproduction occurs they die upon the surface of the ground.

After fertilization the females fly to rich pasture lands, if such are available, and lay their eggs in the soil. Wheat lands and irrigated fields are especially favorable to the insects; in places where the soil is quite dry the larvae live at a depth of 20 centimeters or so, but in moister soil they live nearer the surface, descending to 30 or 40 centimeters below the soil, however, when the time comes to pupate. The damage the species does depends upon the consistency of the soil, not 1 percent of the insects reaching the surface in somewhat solid soil, but in moderately loose soil 15 to 20 percent of the adults may get through.

The author is indebted to Dr. E. A. Chapin, of the United States National Museum, for many courtesies in the preparation of these notes, and also to Miss Phoebe Knappen, of the Biological Survey.

The following generic diagnosis has been made as complete as possible so that the individual specific differences may be noted in as short a space as is feasible.

#### Genus *PHYTHOLAEMA* Blanchard

*Phytholaema* BLANCHARD, Catalogue de la collection entomologique, vol. 1, p. 218, 1850.

*Phytolaema* F. PHILIPPI, Anal. Univ. Chile, 1861, p. 735.—VAN DEN BRANDEN, Ann. Soc. Ent. Belgique, vol. 27, p. cxviii, 1883.—GERMAIN, Anal. Univ. Chile, vol. 108, p. 987, 1901.—ARROW, Ann. Mag. Nat. Hist., ser. 7, vol. 11, p. 305, 1903.—RIVERA, Rev. Chilena Hist. Nat., vol. 8, p. 241, 1904.

*Phytolaema* LACORDAIRE, Genera des coléoptères . . . , vol. 3, p. 226, 1856.—JUNK, Coleopterorum catalogus . . . , pt. 47, p. 91, 1912.

*Areoda* SOLIER, in Gay's Historia física y política de Chile . . . , Zoology, vol. 5, p. 92, 1851.—REDTENBACHER, Reise der österreichischen Fregatte *Novara* . . . , Zoology, vol. 2, Coleoptera, p. 65, 1868.

Robust-oval, strongly shining above. Ligula fused with mentum; labrum small, strongly transverse, bilobately emarginate, well hidden under the overhanging clypeus and separated from the latter by a distinct suture; labium flattened, with faint to moderate median longitudinal groove. Antennae 8-segmented, club 4-segmented in male and 3-segmented in female, with the fifth segment in females of varying length; fourth male antennal segment strongly enlarged and at least three times as long as the third segment. Head with front flattened or slightly convex, clypeal suture evident; clypeus elongate, sides at times nearly parallel, usually slightly convergent anteriorly; apex of clypeus markedly reflexed; eyes usually moderate in size. Thorax strongly transverse, roundly dilated at sides; basal angles distinct but obtuse, front angles rectangular; basal margin arcuate, not margined, lateral margins entire, ciliate; front margin with membranous border. Elytra very slightly longer than broad (about one-fourth longer than broad at most), without membranous border, margin ciliate. Pygidium transverse, visible or not from above; surface slightly convex or flattened, finely moderately densely punctured, with short suberect whitish pile over the entire surface and a varying number of long erect hairs scattered over the discal area; sides at base somewhat concave; center of disk often with several small tubercles. Anterior coxae prominent subtransverse; tibiae distinctly bidentate and with an inner spur (broken off in majority of specimens). Middle and hind femora and tibiae slender and graceful, the latter without transverse ridges; middle tibiae in male with one small apical spur, female with two; hind tibiae in female with two spurs, in male with none. All tarsi with a small subbasal tooth of varying length and prominence. First segment of hind tarsi almost equal in length to the next two combined. Coxae contiguous, metasternum very slightly produced between the middle coxae (especially noticeable in *P. mutabilis*). Abdomen with six visible free segments, densely finely punctured at center, with whitish pile; first four segments subequal in length, fifth as long as or longer than segments 2 to 4 combined, with membranous apical margin; sixth segment one-half the length of fifth in the male, a little longer in the female; abdomen scarcely at all modified as to armature or sexual differentiation. Propygidium and penultimate ventral abdominal segments closely connate, spiracle on the suture but the latter almost obliterated.



## KEY TO THE SPECIES OF PHYTHOLAEMA

1. Thoracic disk distinctly bicolored, much paler at center of disk, and the latter very sparsely punctured, hair usually white; elytra strongly punctured but not rugose..... *mutabilis*  
 Thoracic disk unicolorous or nearly so, center of disk sparsely to densely punctured, hair usually brownish; elytra strongly punctured, subrugose to rugose..... 2
2. Middle tarsi noticeably shorter than tibiae; elytral striae other than sutural hardly evident; thoracic disk sparsely punctured and sparsely pubescent at center; color piceocastaneous, clypeus and under surface lighter..... *flavipes*  
 Middle tarsi equal to or longer than tibiae; elytral striae quite obvious; thoracic disk densely punctured and densely hairy at center; color variable..... 3
3. Color entirely pale testaceous, thorax slightly rufotestaceous; tarsal claws with basal tooth hardly obvious or weakly developed..... *herrmanni pallida*  
 Color rufo- to piceocastaneous; tarsal claws with a strong basal tooth..... *herrmanni*

## PHYTHOLAEMA MUTABILIS Blanchard

## FIGURE 1, a-c

*Phytholaema mutabilis* BLANCHARD, Catalogue de la collection entomologique, vol. 1, p. 218, 1850.

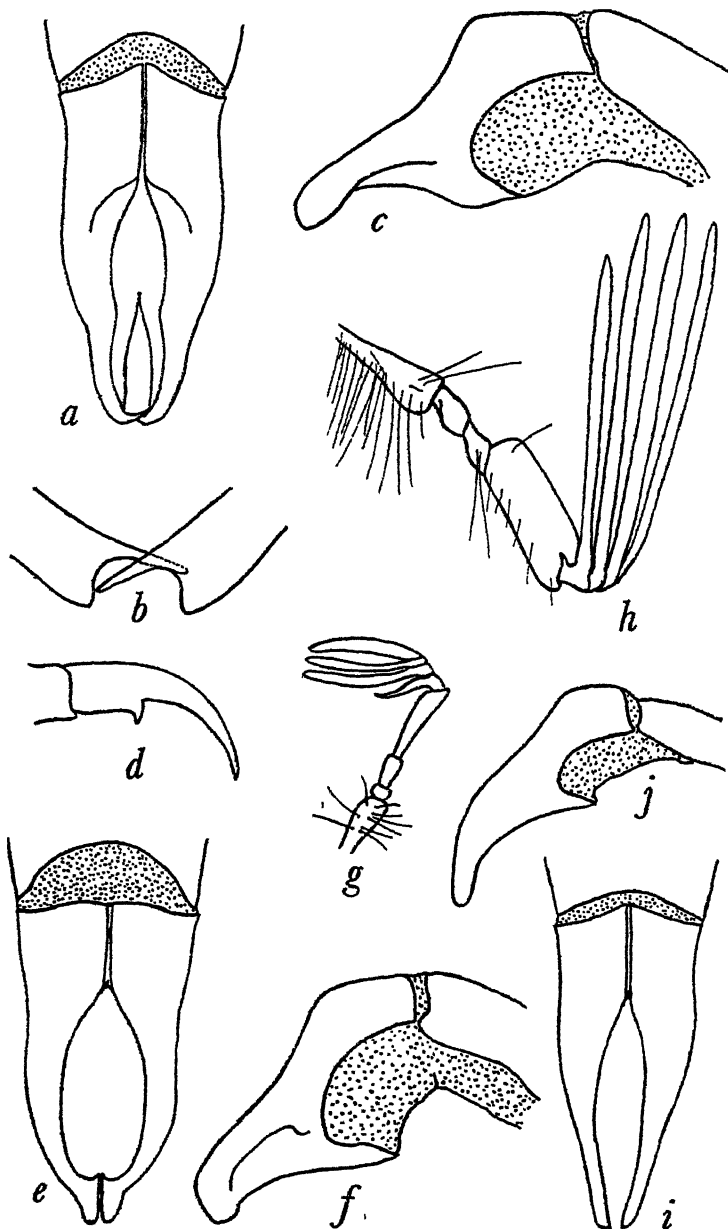
*Areoda mutabilis* SOLIER, in Gay's Historia fisica y politica de Chile . . ., Zoology, vol. 5, p. 98, 1851.

*Phytoloema mutabilis* GERMAIN, Anal. Univ. Chile, vol. 108, p. 1000, 1901.

Testaceous to rufotestaceous; thorax bicolored, rufocastaneous at sides, testaceous at center; head except clypeus with greenish luster; clypeus, legs, and elytra testaceous. Clypeus with short erect hair, apex very strongly reflexed, sides nearly parallel. Antennae with fifth male segment three-fourths the length of the sixth, and fifth female segment one-fourth the length of the sixth or less. Thorax very finely sparsely punctured, subglabrous at center of disk, otherwise with long whitish hairs. Scutellum entirely impunctate. Elytra subglabrous, moderately coarsely punctured, not rugose, without any raised striae. Metasternum usually nude. Middle tarsi noticeably shorter and hind tarsi a little shorter than their respective tibiae. Length, 12 to 14 mm; width, 6.5 to 7.8 mm.

Specimens examined: 6 males and 7 females, from "Santiago" and from "Chile."

A very distinct species by the characteristic coloring, the bicolored thorax, and the genitalia of the male. The male and female antennae differ in length from those of the same sex of *herrmanni* as noted in the diagnoses.

FIGURE 1.—Species of *Phytholaema*

*a-c*, *P. mutabilis*: *a*, En face view of male genitalia; *b*, enlarged en face-ventral view of male genitalia; *c*, lateral view of male genitalia.

*d-h*, *P. herrmanni*: *d*, Hind tarsal claw; *e*, en face view of male genitalia; *f*, lateral view of male genitalia; *g*, female antenna; *h*, male antenna.

*i, j*, *P. flavipes*: *i*, En face view of male genitalia; *j*, lateral view of male genitalia.

## PHYTHOLAEMA HERRMANNI Germain

FIGURE 1, d-h

*Phytoloema herrmanni* GERMAIN, Anal. Univ. Chile, vol. 108, p. 994, 1901.—  
RIVERA, Rev. Chilena Hist. Nat., vol. 8, p. 241, 1904 (biology).

Piceotestaceous, elytra somewhat lighter, thorax very slightly lighter at center of disk but not distinctly bicolored, clypeus and legs testaceous. Head with front piceous, coarsely densely punctured; clypeus with dense, long, erect hair, apex moderately reflexed. Thorax somewhat coarsely densely punctured over entire disk and with long erect brownish hair. Scutellum sparsely punctured. Elytra coarsely punctured, slightly rugose, with four distinct oblique carinae on each elytron, with several scattered long erect hairs. Metasternum usually densely hairy. Middle and hind tarsi equal to or longer than their respective tibiae. Antennae with the fifth segment seven-eighths the length of the sixth in the male, and one-third or almost one-half the length of the sixth in the female. Length, 11 to 12 mm; width, 6.5 to 7.5 mm.

Material examined: 6 males, 2 females, from "Angol" (Sept. and Oct.) and from "Galvarino" (Sept.), Chile.

The fifth segment of the antennae in both sexes is consistently a little longer than the same segment in the like sex of *mutabilis*. The present species differs from the two others in the genus especially in the longer middle and hind tarsi, as well as in the much more densely punctured and more hairy thorax and in the strongly evident elytral striae.

## PHYTHOLAEMA HERRMANNI PALLIDA, new subspecies

Entirely testaceous. Body robust and somewhat shorter than in the typical species. Tarsal claws with basal tooth varying from rather fine and smaller than in the typical form to being almost absent. Other characters as in typical *herrmanni*. Length, 9 to 10 mm; width, 5.5 to 6 mm.

*Holotype* and *paratype*, both males (U.S.N.M. no. 52093) are from "Southern Chile" and were collected by M. J. Rivera.

A very conspicuous form presenting a different appearance superficially from *herrmanni* but in reality only a subspecies of that; all the major characters except the color, size, and tarsal claw formation are as in the typical form. The male genitalia are also identical with those of *herrmanni*.

## PHYTHOLAEMA FLAVIPES Philippi

FIGURE 1, *i, f*

*Phytolaema flavipes* PHILIPPI, Anal. Univ. Chile, 1861, p. 735.—VAN DEN BRANDEN, Ann. Soc. Ent. Belgique, vol. 27, p. cxviii, 1883.—GERMAIN, Anal. Univ. Chile, vol. 108, p. 996, 1901.

*Areoda elaphocera* REDTENBACHER, Reise der österreichischen Fregatte *Novara* . . . , Zoology, vol. 2, Coleoptera, vol. 2, p. 65, 1863.

Entirely piceocastaneous above; head with light greenish luster on front; clypeus and underparts testaceous. Clypeus moderately strongly reflexed. Antennal club of male with fifth segment three-fourths the length of the sixth. Thorax unicolorous, finely moderately densely punctured over disk, more coarsely punctured with long erect hair at sides. Scutellum sparsely punctured. Elytra rugose, nonstriate. Hind tarsi shorter than tibiae, middle tarsi distinctly so. Claws with strong subbasal tooth. Length, 9.5 mm; width, 5.5 mm.

Material examined: 1 male from "Southern Chile", collected by M. J. Rivera.

The combination of the unicolorous dorsal surface, the short middle and hind tarsi, and the rugose but nonstriate elytra will readily separate this species from the others; the genitalia are also slenderer and quite different from those of the other two species in the genus.





SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1937

No. 3029

# REDESCRIPTION OF THE CAPELIN MALLOTUS CATER- VARIUS (PENNANT) OF THE NORTH PACIFIC

By LEONARD P. SCHULTZ <sup>1</sup>

PALLAS (1826 <sup>2</sup>, pp. 389–390) described as new *Salmo socialis*, a capelin from the islands situated between the continents of Asia and America. Additional specimens of capelin collected in the north-eastern Pacific in recent years have made it possible to study the differences between the capelins of the North Atlantic and North Pacific Oceans. Since the publication in which Pallas's description appeared is rare, the following quotation is given:

269. SALMO *socialis*. TAB. LXXXI. fig. 2.

S. (Osmerus) fascia laterali ciliata, radius pinnae ani 22.

Clupea (villosa) linea laterali prominula, hirta, Muller *prodr. Zool. Dan.*  
p. 60. n. 125. Gmelin. *syst. III*, p. 1409. sp. 14.

Pisces sunt gregarii et acervis innumerabilibus circa initium et usque ad medium Junii, maris fluctibus in littora egeruntur, tanta copia, ut instar aggeris ad dimidiae ulnae altitudinem coacervati jaceant. Observatur hoc tam in insulis inter Asiae et Americae continentes sitis, quam in Camtschatca, nullibi autem majori frequentia quam circa sinum Avatscha et ad ostia rivulorum Shupanova et Schemaetschik. Mirum autem quod, ope lineae lateralis ciliatae, pisces plerumque plures, duo, tres et usque ad denos ita firmiter cohaerent, ut sublato uno reliqui velut adglutinati sequantur. Videntur autem etiam in mari sic cohaerere natantes, et forte ad proliferationis negotium talis sexuum cohaesio requiritur. Odorem spargunt virosum, spermatis ranarum aemulum, ut Osmeri alii et cito

<sup>1</sup> The author was assisted by his former student George B. Garlick in obtaining data from specimens taken at Newfoundland and at Yakutat.

<sup>2</sup> The year 1826 instead of 1831 as usually cited by authors appears to be the date of publication as cited by Mertens and Lorenz (1928, p. 46) with some doubt. The title page was printed in 1831, according to Dr. L. Stejneger.

putrescunt, ac si prima vice comesti palato arriserint, altera tamen vice non appetuntur. Hinc exsiccari tantum solent pro canum pabulo, nec illis sunt salubres, quippe debilitatos inde alvi profluvium pati observatum est. Dira tamen famas etiam incolas harum regionum cogit ad tale nutrimentum recurrere.

*Descr.* *Forma* accedit ad *Osmerum Spirinchum*, quo major est; longitudinem tamen 7 poll. latitudine unum nunquam superant. *Caput* longum, compressum, rostro producto, vertice plano. *Maxilla inferior* superiore longior et angustior; *riktus* amplius; *nares* utrinque geminae contiguac, in fossula oblonga, medio inter oculos et rostri-apicem spatio. *Oculi* ad verticem, a rostro remotiusculi, majusculi; *Iris* lata, aureo-argentea, *pupilla* versus rostrum ovata. *Lingua* acuta. *Dentes* min[u]tissimi, tactu tantum explorandi, in margine maxillarum, laminae mystaceae, areola linguae, et duplici stria palati.—*Opercula* branchiarum argentea, rotundata late hiantia; *Flabella branchialia* decemlamellata. *Corpus* compressum, microlepidotum, dorso subolivaceo opaco, cum relucente virore, lateribus secundum lineam lateralem subaureolis, infra eandem purissime argentea. *Linea lateralis* rectissima, dorso vicinior  $\frac{1}{2}$ ; supra eandem continua *fascia* 1 lineam lata, hispida, obsita *squamulis* subtilissimis, setaceoacutis, subarrectis. *Squamae* etiam *carinae ventralis* setaccae, acutae, serraturam efficientes (unde *Müllero Clupea* dictus); in reliquo corpore minutissimae, strictae, ut in *Eperlano*. *Pinnae pectorales* ad ipsa opercula oblique ortae, magnae, 18 radiorum, quorum duo anteriores simplices; p. *ventrales* dorsali oppositae, itidem ortu obliquo, octoradiatae; *appendiculae* squamiformes, ut in *Eperlano* et *Spirincho* nullae. P. *ani* magna, lata, segmentum circuli referens, insidensque carinae carnosoradiatae, valde prominulae, ipsa constans radiis 21 vel 22. P. *dorsi* subquadrata, radiorum 12; *adiposa* ante caudam tenuissima, arcuata, totaque longitudine adnata. *Cauda* argute forcipata, radiis 18. articulatis. *Vertebrae* 68.

The binominal name of Pallas, as defined above, has been accepted by all recent authors as the oldest name given to the capelin of the North Pacific. During his investigations of the life of Steller, however, Dr. L. Stejneger, head curator of biology of the United States National Museum, found a still older name—"Salmo catervarius of Steller"—which was published by Thomas Pennant<sup>3</sup> in his *Arctic Zoology* (1784, vol. 1, p. cxxvii), his description being quoted in full below:

The most singular is the Oukik, or *Salmo Catervarius* of Steller. It belongs to the *Osmeri* of Linnaeus. Swims in immense shoals on the eastern coast of *Kamtschatka*, and the new-discovered islands, where it is often thrown up by the sea to the height of some feet, upon a large extent of shore: is excessively unwholesome as a food, and causes fluxes even in dogs. It never exceeds seven inches in length. Just above the side-line is a rough fascia, beset with minute pyramidal scales, standing upright, so as to appear like the pile of shag: their use is most curious—while they are swimming, and even when they are flung on shore, two, three, or even as many as ten, will adhere as if glued together, by means of this pile, insomuch that if one is taken up, all the rest are taken up at the same time.

To conclude this list of *Kamtschatkan* Salmon, I must add the *Salmo Thymallus*, or Grayling; the *S. Cylindraceus*, before described; the *Salmo Albula*, Lin. Syst. 512; and the *Salmo Eperlanus*, or common Smelt, to those which ascend the rivers.—For this account I am indebted to Doctor Pallas, who extracted it from the papers of Steller, for the use of this Work.

<sup>3</sup> Sherborn in his *Index Animalium* (1902, p. vliii) states that "no sp. nn.", no specific names, were given, which is an error.

Steller (1774, p. 149) also gives an account of the capelin, from which Pennant no doubt obtained most of his information given above. I quote below Dr. L. Stejneger's translation of this reference on the capelin:

During June and July [old style Julian Calendar] such incredible numbers of a small fish, five or six inches long, are cast ashore about Avatcha [bay] and the mouth of the river Kamtchatka that they lie two to three feet high on the beach, two and two, male and female usually adhering together. In both Itelmanian [Kamtchadal] languages they are called Uiky. They are gathered in great quantities, dried in the open air on the sand or on straw mats, and in the winter these fishes are common food for the dogs at the Kamtchatka River. The people pound the dried fishes, skin and bone, in large wooden tubs or mortars and bake them like flour in many ways, and during famine times they become often of great importance. On June 5, 1742 [old style], such quantities were thrown up on Bering Island by northwest wind that they were lying on the beach two feet high.

Pennant took his account of *M. catervarius* from Steller but does not give the type locality. In Steller's account above "Bering Island", "Avatcha bay", and "the mouth of the river Kamtchatka" are given as the type localities of *catervarius*. Therefore, in the National Museum the following specimens are topotypes: U.S.N.M. nos. 33876, 47560, and 48856.

The description by Pallas of the capelin of the North Pacific did not furnish adequate data to make it possible to distinguish it from the Atlantic form, *Mallotus villosus* (Müller),<sup>4</sup> nor does the older one by Pennant. Ichthyologists have referred the capelin of the North Pacific to the synonymy of *Mallotus villosus*, which is now removed from the synonymy of that form and restored to the rank of a distinct species, *Mallotus catervarius* (Steller, in Pennant, 1784). The capelin of the North Atlantic, then, retains the name *Mallotus villosus* (Müller).

In July 1929, Fenton Drake sent the author a mature male of *Mallotus*, which measured 100 mm in standard length. This fish was collected near the Pillar Bay Cannery, Kuiu Island, southeastern Alaska. The small size of this mature capelin caused the author to search for additional specimens. He mentioned the probability of a new form of *Mallotus* to Dr. W. F. Thompson, director of investigations of the International Fisheries Commission, Seattle, Wash., who kindly turned over a collection of the same form, taken off the wharf at Yakutat, Alaska, U.S.N.M. no. 103127. Two additional specimens, U.S.N.M. no. 103128, collected by Ira Cornwall at Bentinck Island, British Columbia, winter of 1934-1935, were presented to the author by G. V. Wilby. All the specimens examined are listed in table 1.

<sup>4</sup> *Clupea villosa* Muller, 1776, p. 50.



TABLE 1.—*Specimens of Mallotus catervarius (Pennant) examined in this study*

U.S.N.M. no.	Locality	Date collected	Collector
27564.....	Plover Bay, Siberia.....	Aug. 12, 1880....	T. H. Bean.
27579.....	do.....	Aug. 13, 1880....	E. P. Herendeen.
27563.....	do.....	Aug. 12, 1880....	T. H. Bean.
82949.....	Golofnin Bay, Alaska.....	June 1880.....	E. W. Nelson.
47560.....	Bering Island.....	June 1895.....	L. Stejneger.
24038.....	Bering Strait.....	.....	John Rodgers and William Stimpson.
33376.....	Bering Island.....	June 19, 1882....	L. Stejneger.
48856.....	do.....	1896.....	N. Grebniński.
103127.....	Yakutat, Alaska.....	Feb. 3, 1927.....	International Fisheries Commission.
103128.....	Bentinek Island, British Columbia.....	Winter 1934-35..	Ira Cornwall.
[Not in U.S.N.M.]	Kuin Island, Alaska.....	July 1929.....	Fenton Drake.

Sleggs (1933, pp. 9-16), in his study of the capelin of the Newfoundland region, recognized but a single species, *Mallotus villosus* (Müller), although he states that certain evidence indicates the possibility of races or of specific differences. Sleggs's map of the geographical distribution of *Mallotus* shows it to have a wide range, occupying the northern seas of the Atlantic and Pacific Oceans. However, according to his map, and the apparent lack of records of its occurrence off the north coast of Siberia, its distribution is not known to be circumpolar. The capelin occurs as far south as the "climatic isotherm 45° F. (mean annual temperature)" (Sleggs, 1933), which indicates a range in the Pacific Ocean as far south as Vancouver Island, where it was collected and brought to my attention by G. V. Wilby. It has been taken as far south as Korea along the Asiatic Continent. Throughout this wide range it is to be expected that the species might have become differentiated into subspecies or species, as has been found for the halibut (Schmidt, 1930) and for the codfish (Schultz and Welander, 1935).

#### REDESCRIPTION OF MALLOTUS CATERVARIUS (PENNANT)

The genus *Mallotus* has 170 to 220 scales along the lateral line, more than in any other genus of osmerid fish, and because of the villous bands of scales along the lateral line on the breeding male (Hubbs, 1925, p. 51) it can not be confused with any other genus referred to the family Osmeridae. There is a superficial resemblance between the dilated bands of scale pockets on the sides of the breeding males of *Spirinchus dilatatus* Schultz and Chapman (1935, p. 68) and the greatly elongate scales ("villous" scales) of *Mallotus* (Sleggs, 1933, fig. 8), but upon examination with a microscope the differences are at once apparent as described by Schultz and Chapman. The structure and shape of the villous scales of *M. catervarius* were found not to differ from those of *M. villosus*.

TABLE 2.—Counts made on *Mallotus* from the North Pacific and the North Atlantic<sup>1</sup>

Character	<i>M. villosus</i>		<i>M. catervarius</i>			
	Newfound-land <sup>2</sup>	Murman coast	Alaska and British Columbia	Bering Sea and Okhotsk Sea	Korea <sup>3</sup>	Islands between Alaska and Asia <sup>4</sup>
Dorsal fin rays.....	{12-14 (47) 12.85±0.37	13-14 (3) 13.67 —	12-13 (54) 12.19±0.27	10-13 (14) 12.00±0.51	13 (1)	12 (1)
Anal fin rays.....	{17-22 (47) 19.32±0.57	19-21 (3) 19.67 —	17-20 (55) 18.34±0.53	17-20 (16) 18.62±0.63	20 (1)	21 and 22 (?)
Pectoral fin rays.....	{18-20 (47) 19.19±0.41	-----	17-19 (53) 17.49±0.39	-----	16 (1)	18 (1)
Principal caudal fin rays.	{19 (36) 19	-----	19-20 (52) 19.02±0.09	-----	-----	18 (1)
Pelvic rays.....	8 (36)	-----	8 (56)	-----	-----	8 (1)
Scales in lateral line <sup>5</sup> .....	{175-219 (46) 199.16±1.02	204-217 (3) 210.0 —	175-209 (53) 189.08±0.97	170-194 (8) 185.37±4.95	-----	-----
Scales above lateral line.....	{18-23 (28) 20.64±0.96	22-23 (2) 22.5 —	15-19 (12) 16.84±1.21	19-22 (9) 19.78±0.62	-----	-----
Scales below lateral line.....	{16-22 (43) 18.95±1.21	18-20 (3) 19.33 —	15-17 (52) 15.73±0.48	14-18 (8) 15.25±0.81	-----	-----
Vertebrae.....	{64-68 (33) 65.91±0.80	-----	63-68 (35) 65.86±0.76	-----	-----	68 (1)
Gill rakers on first arch above angle.....	{8-11 (47) 9.23±0.63	10-11 (3) 10.33 —	9-12 (56) 9.93±0.48	9-11 (17) 9.59±0.40	-----	-----
Gill rakers on first arch below angle.....	{24-31 (45) 27.11±0.96	28-29 (3) 28.33 —	28-31 (54) 29.50±0.55	26-30 (17) 27.83±0.70	-----	-----
Total number of gill rakers on first arch.....	{33-42 (47) 36.45±1.29	38-39 (3) 38.67 —	37-42 (53) 39.36±0.82	35-40 (17) 37.41±0.90	35 (1)	-----

<sup>1</sup> The figures for each character show in the first line the minimum and the maximum count or measurement, and in parentheses the number of specimens counted or measured; in the second line the mean and probable error of the mean are given. The measurements are expressed as hundredths of the standard length. The last two rays of the dorsal and anal fins, often branching from a common base, were counted as one ray.

<sup>2</sup> These specimens from Newfoundland were obtained through the kindness of Dr. Harold Thompson.

<sup>3</sup> Data from Mori (1930).

<sup>4</sup> Data from Pallas (1831).

<sup>5</sup> The number of scales in the lateral line, counted, indicates the number of oblique rows from upper edge of gill opening along the side of the body to the base of the rays of the caudal fin.

Tamezo Mori (1930, p. 5) described as new *Mallotus elongatus* from the Tumen River mouth at Keiko, Korea. Since his description is abbreviated and apparently standard measurements and terminology were not used, few comparisons can be made. He says: "This specimen is closely related to *M. villosus* Cuvier, differing from it in having slenderer body and very minute scales without larger scales along lateral line." Obviously Mori did not know that only the males of *Mallotus* have the enlarged or villous scales along the lateral line. He did not give a scale count for his young female, 93 mm in total length. The slender body was given by Mori as "depth 8.2" in body length. There is no indication anywhere in his paper as to what "body length" means. However, if "body length" is the same as total length, then the depth of the body is 11.3 mm, or 12 percent of the total length. It was found that the length of the caudal fin rays of *Mallotus*, in both the Atlantic and Pacific, averages about 12 mm on specimens having

a total length of 93 mm, so if the standard length was used by Mori it would be about 81 mm on his specimen. Thus the depth would be 7 mm, which is 9 percent of the standard length. The depth of the body in specimens from both oceans varies from 12.1 to 21.6 percent

TABLE 3.—Measurements made on *Mallotus* from the North Pacific and North Atlantic Oceans<sup>1</sup>

Character	<i>M. villosus</i>	<i>M. catervarius</i>
	Newfound-land <sup>2</sup>	Alaska and British Colum- bia
Length of head.....	{ 21.3-24.8 (36) 22.71±0.52	23.6-26.3 (52) 24.94±0.44
Width of head.....	{ 8.0-10.8 (32) 9.33±0.40	8.4-9.8 (53) 9.07±0.23
Length of maxillaries (tip of snout to posterior tip of maxillary).....	{ 9.6-11.6 (36) 10.69±0.30	10.8-12.5 (53) 11.72±0.29
Width of fleshy interorbital space.....	{ 4.9-6.5 (36) 5.80±0.24	4.9-6.3 (53) 5.55±0.22
Diameter of eye.....	{ 4.6-6.5 (32) 5.38±0.24	5.8-7.1 (53) 6.49±0.18
Greatest depth of body.....	{ 13.6-21.6 (36) 17.88±1.90	12.1-15.0 (53) 13.47±0.60
Length of snout.....	{ 7.0-8.6 (21) 7.76±0.25	7.3-8.9 (53) 8.17±0.22
Length of longest gill raker on first arch.....	{ 3.1-4.3 (36) 3.65±0.18	3.2-4.4 (53) 3.76±0.19
Length of depressed dorsal fin.....	{ 16.5-20.5 (32) 18.64±0.16	15.5-18.5 (53) 17.09±0.51
Length of longest caudal fin ray.....	{ 13.5-17.5 (36) 15.3±0.59	14.0-18.0 (53) 16.10±0.57
Length of longest dorsal fin ray.....	{ 10.3-13.9 (36) 12.19±0.56	11.1-14.8 (53) 12.99±0.57
Length of longest pectoral fin ray.....	{ 10.5-15.5 (36) 12.64±0.88	11.0-16.5 (53) 13.94±0.81
Length of longest pelvic fin ray.....	{ 11.5-16.0 (36) 13.80±0.88	12.0-16.0 (53) 14.43±0.67
Length of longest anal fin ray:		
Males.....	{ 7.6-9.2 (19) 8.33±0.29	7.5-9.5 (46) 8.43±0.29
Females.....	{ 5.2-7.9 (16) 6.16±0.41	5.6-6.3 (7) 5.95±0.17
Length from snout to insertion of anal fin.....	{ 67.0-76.5 (36) 72.50±1.11	71.0-76.0 (52) 73.20±0.74
Length from snout to origin of adipose fin.....	{ 78.5-83.5 (36) 81.17±0.84	79.0-83.5 (53) 80.78±0.57
Length from snout to origin of dorsal fin.....	{ 50.6-57.6 (36) 54.00±1.41	52.9-58.2 (53) 55.28±0.74
Length from snout to insertion of pectoral fin.....	{ 20.0-25.5 (36) 21.28±0.64	23.0-26.5 (53) 24.80±0.51
Length from snout to insertion of pelvic fin.....	{ 50.0-57.5 (36) 53.95±1.35	52.0-56.5 (53) 54.14±0.67
Least depth of caudal peduncle.....	{ 4.9-7.3 (36) 6.22±0.43	5.4-6.9 (52) 6.05±0.24
Length of caudal peduncle.....	{ 8.9-12.1 (36) 10.38±0.55	8.3-11.7 (53) 10.25±0.52
Length from insertion of pectoral fin to pelvic fin.....	{ 30.2-36.0 (36) 32.52±0.84	28.4-32.9 (52) 30.55±0.65

<sup>1</sup> See footnote 1 to table 2.

<sup>2</sup> See footnote 2 to table 2.

of the standard length. These were all mature fish and in a spawning condition. Young smelt are usually slenderer than the adults, which may explain the "slenderer body."

Tentatively,<sup>5</sup> *Mallotus elongatus* Mori is referred to the synonymy of *Mallotus catervarius* on the basis that the type locality, Korea, is in the North Pacific and the lack of characters separating it from species already described.

The specimens of *Mallotus catervarius* that were mature ranged in length from 89 to 109 mm (average 95.8 mm), while the mature specimens of *Mallotus villosus* from Newfoundland, measured by us, were 129 to 166 mm (average 150.7 mm) in standard length. Sleggs (1933, pp. 22-23) gives the lengths from 106 to 202 mm for breeding individuals. This indicates that the capelin of the North Pacific Ocean matures at a much smaller size than the capelin of the North Atlantic Ocean. Besides the smaller size at maturity, table 4 indicates that *M. catervarius* differs statistically from *M. villosus* in regard to the following characters: Number of pectoral fin rays; number of scales in the lateral line; number of scales above and below the lateral line; length of head; length of maxillaries; and length from snout to insertion of pectoral fin.

A single specimen of *M. catervarius* may be distinguished from a single specimen of *M. villosus* by means of the *character index*, which equals the number of fin rays in dorsal + anal + pectoral + the number of scales below the lateral line — the total number of gill rakers, for each individual specimen. When the numerical values of the character index are arranged in the form of a frequency table (table 5), no overlapping of the frequencies occurs for *catervarius* and *villosus*. The difference between the means of the character index for the two species is 7.84 and the ratio of this difference to the square root of the sum of the squares of the two probable errors is 4, indicating probable significance.

TABLE 4.—The differences between the means of certain characters of *Mallotus catervarius* and *M. villosus* and the ratio of these differences to their probable error

Character	Difference between means (with probable error)	Ratio of difference to probable error
Number of rays in pectoral fin.....	1.70±0.57	3.0
Number of scales in lateral line.....	10.03±1.41	7.1
Number of scales above lateral line.....	3.80±1.55	2.5
Number of scales below lateral line.....	3.22±1.30	2.5
Length of head.....	2.23±0.68	3.3
Length of maxillaries.....	1.03±0.41	2.5
Length from snout to insertion of pectoral fin.....	2.52±0.82	3.1

<sup>5</sup> During the past four years I have tried repeatedly to obtain capelin from Korea, but without success. When a large series of *Mallotus* from Korea are studied, *M. elongatus* may prove to be a valid species.

TABLE 5.—Frequency distribution of the character index<sup>1</sup>

Species	Character index																		Total	Mean	Probable error
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38				
<i>Mallotus catervarius</i> .....	3	8	9	14	4	11	2	---	---	---	---	---	---	---	---	---	---	51	25.96	±1.09	
<i>Mallotus villosus</i> .....	---	---	---	---	---	---	---	---	4	4	3	4	7	3	4	4	2	35	33.80	±1.62	

<sup>1</sup> For definition see text, p. 19.

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SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1938

No. 3030

A MIOCENE BOOBY AND OTHER RECORDS FROM THE  
CALVERT FORMATION OF MARYLAND

By ALEXANDER WETMORE

SYSTEMATIC search in the Miocene deposits of Chesapeake Bay has brought to attention the remains of many cetaceans, but discoveries of birds have been relatively few. The fossils in these beds are found in moist clay, a condition destructive to delicate bones such as those of birds, which may account for the relative scarcity of this group in the formation in question.

Several years ago I reviewed what bird material was available from these deposits,<sup>1</sup> noting only two species that were definitely identified—*Puffinus conradi* Marsh and *Moris lowostyla* (Cope), the bird named *Sula atlantica* by Shufeldt being a synonym of the latter.

Though the Calvert cliffs are kept regularly under observation, no further pertinent bird material came to hand until 1934, when Dr. W. Gardner Lynn and R. Lee Collins, of Johns Hopkins University, began an intensive survey of the stratigraphy of the Miocene along Chesapeake Bay and its tributaries. This work has been continued by Mr. Collins subsequent to his departure from Johns Hopkins. Specimens obtained by these gentlemen have been placed in the United States National Museum, and the notes herein discuss the avian material found to 1937 in their collecting.

Figures illustrating certain specimens have been made for me by Sydney Prentice.

<sup>1</sup> Auk, 1926, pp 462-468

## Family PROCELLARIIDAE

## PUFFINUS species

A specimen (U.S.N.M. no. 15160) comprising about two-thirds of the distal portion of a right humerus was obtained by R. Lee Collins on March 30, 1937, on the beach about 1 mile south of the Chesapeake Beach pier. It is well fossilized, dull brown in color, and evidently a bone that has weathered out from the Calvert formation in the adjacent cliffs.

It is from a species of the dimensions of living Cory's shearwater (*Puffinus diomedea borealis*), being distinctly larger than *P. conradi* from the Miocene of Maryland, and it evidently represents an undescribed form. Unfortunately it has been worn in the sands of the beach until the projecting processes of the distal end have lost those characters that serve to characterize species in this group. While obviously different from Cory's shearwater because of its antiquity, no characters remain in the bone that will serve to separate it in a technical diagnosis. It is listed therefore for the present under the generic name only.

It has the following measurements: Greatest transverse diameter across the distal end, 14.9 mm; transverse diameter of shaft near center, 6.7 mm.

## Family SULIDAE

## SULA AVITA, new species

*Characters*.—Lower end of humerus (fig. 2) similar to that of modern *Sula piscator* (Linnaeus)<sup>2</sup> but much smaller; ectepicondylar process less prominent; brachial depression shallower; olecranal fossa relatively smaller and less deeply impressed.

*Type*.—U.S.N.M. no. 13854, distal end of right humerus (processes somewhat broken), collected in situ in zone 10, Calvert formation of the upper Miocene, near Plumpoint, Md., on January 1, 1934, by Dr. W. G. Lynn.

*Description*.—Shaft compressed at distal end, flattened on anterior face, with the inner margin thin edged, rounding from this to join the outer margin at a right angle; ectepicondylar process slight, extending out in a gradual curve; radial trochlea (partly broken away) comparatively small; ulnar trochlea rounded, elongate, globular, projecting distally distinctly below the level of the radial trochlea; tubercle for *pronator brevis* elongate, triangular, rising in a low point; brachial depression flat and slightly impressed; olecranal fossa relatively shallow. Bone dull brown in color, not mineralized, but with all organic matter removed so that it appears slightly porous.

<sup>2</sup> *Pelecanus piscator* Linnaeus, *Systema naturae*, ed 10, vol. 1, 1758, p. 134.

*Measurements.*—Transverse diameter of shaft, 9.5 mm; breadth of distal end, 15.2 mm.

*Remarks.*—A fossil gannet, *Moris lowostyla* (Cope), is known from the Miocene deposits of Calvert County, Md., but it is so much larger, having the distal end of the humerus 21.1 mm,<sup>3</sup> that it may be dismissed without detailed comment. Further, the species here described seems related to the true boobies of the genus *Sula*, the humerus of which differs from that of *Moris* in the more shortened insertion for the pronator muscles and the broader radial condyle.

In size *Sula avita* approaches *S. pygmaea* Milne Edwards<sup>4</sup> from the lower Miocene deposits of Léognan (faluns de Saucats), France. From the original description and figures it appears that *S. pygmaea* is slightly smaller. *Sula avita* in addition differs in the conformation of the ectepicondylar area, which is larger, and also in the form of the olecranal depression. *S. pygmaea* possibly is not properly placed in the genus *Sula*.

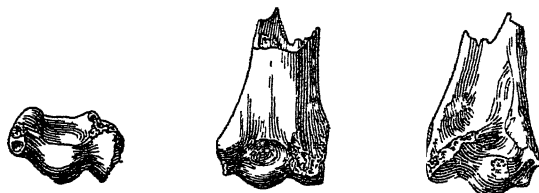


FIGURE 2.—Type of *Sula (Microsula) avita*, new species: Lower end of humerus. About natural size.

The type of *Sula avita* was the first specimen to come to hand, but it has been followed by other fragments that are identified as from this same species. Most important of these is a nearly complete left metacarpal bone (U.S.N.M. no. 15158) collected by R. Lee Collins on July 3, 1936, from zone 10 in the Calvert formation, 2 feet below the top of the thick shell bed, at a point 1.1 miles south of Plumpoint, Md. While apparently from a larger individual than the fragmentary humerus taken as the type of *avita*, the proportionate difference between the two is about that existing between male and female of *S. piscator*.

The specimen (fig. 3) differs from *Sula piscator* in having the projecting process of metacarpal I rising more abruptly, with the entire process larger, and in the much smaller pneumatic foramina on the proximal end, these being almost closed. Its form and characters are shown in the accompanying drawings.

There is also the shaft of a right humerus (U.S.N.M. no. 15157) that is referred to this species. This specimen was found by R. Lee

<sup>3</sup> See Wetmore, Auk, 1926, p. 468.

<sup>4</sup> Bibl. École Hautes Études, vol. 11, art. 3, 1874, p. 8, pl. 12, fig. 2-23.



Collins in zone 10 of the Calvert formation, at the beach level 1 mile south of Plumpoint on April 7, 1934. The specimen consists of a little more than the proximal half of the bone, with the head missing but with the lower part of the deltoid crest present. The shape is similar to that of *Sula piscator* except for decidedly smaller size. The line of attachment for the *latissimus dorsi anterioris* muscle is strong and heavy, running for most of its course above the central axis of the bone when viewed from the side.

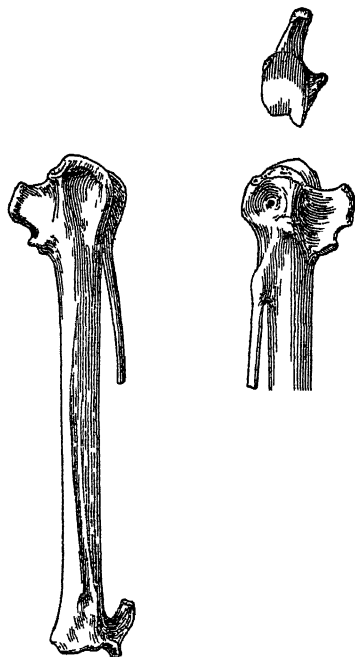


FIGURE 3.—*Sula* (*Microsula*) *avita*, new species: Left metacarpal, including profile views of the proximal and distal ends. About natural size.

In summary, the impression given by this fragmentary material is that of a booby decidedly smaller than any of the living species. In size it resembles most closely the fossil *Sula pygmaea* of the Miocene of Europe but differs from that species in the form of the distal end of the humerus.

The nearly obsolete pneumatic foramina, so prominent in modern gannets and boobies, is remarkable, indicating that this pneumaticity has been a more recent development than other characters that mark this family. Data on this point from other Miocene sulids will be of

interest when they become available. To signalize this character in *Sula avita* I propose to erect for it *Microsula* as a new subgenus, with *Sula (Microsula) avita* as its type.

#### MORIS species

On July 10, 1937, Mr. Collins secured the proximal end of a right ulna of a bird of this group at a point 1 mile south of Plumpoint wharf. The bone (U.S.N.M. no. 15475) was obtained from zone 10, about 2 feet above the heavy shell layer. Though there is some individual variation in the modern species of gannets, the genus *Moris* differs from the boobies, genus *Sula*, in having the internal cotyla of the ulna more elongated in form. This does not always hold but is true in a number of specimens that I have seen. The Plumpoint specimen is referred to *Moris* on this basis.

The fragment seems to come from a bird slightly larger than living *Sula leucogaster*. It appears to be from a smaller individual than the bones that are known from *Moris laxostyla* (Cope) but may be that species, which comes from the Miocene of Maryland and New Jersey. It is identified, however, only to genus.

#### Family COLUMBIDAE

A distal portion of a left radius (U.S.N.M. no. 15159) collected by R. Lee Collins, September 8, 1936, 1.6 miles south of Plumpoint, Md., in zone 10 of the Calvert formation, represents a species of the pigeon family. It comes from a bird slightly larger than the living mourning dove (*Zenaidura macroura*).

Though it is an interesting record of a member of this group, it cannot be identified except to family because of its fragmentary nature and the lack of specific characters in the radius of birds in general. It is the oldest record in North America for this group of birds.





issued by the  
SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1938

No. 3031

## ANOTHER FOSSIL OWL FROM THE EOCENE OF WYOMING

By ALEXANDER WETMORE

DURING the field season of 1931, M. V. Walker, working under C. W. Gilmore, curator of vertebrate paleontology in the United States National Museum, collected a few fragmentary fossil bird bones in a Wasatch exposure near Worland, Wyo. This material, which has recently come to attention during the laboratory preparation of the final specimens from this field season, contains an undescribed species of the family Protostrigidae that may be known as

### PROTOSTRIX MIMICA, new species

*Characters*.—Distal end of tibiotarsus (fig. 4) similar to that of *Protostrix leptosteus* (Marsh)<sup>1</sup> but decidedly smaller; outer condyle heavier.

*Type*.—U.S.N.M. no. 15156, distal end of right tibiotarsus, collected July 23, 1931, on the south side of Ten Mile Creek, 12 miles northwest of Worland, Wyo., by M. V. Walker, from the Wasatch formation of the Eocene.

*Description*.—External condyle reniform in outline (somewhat distorted by pressure), its external face concave, projecting well beyond the line of the shaft both in front and in back; internal condyle viewed in outline distinctly flattened, projecting considerably forward beyond the line of the shaft and to a less degree behind, the external face concave, viewed from the distal end, broad and flattened; intercondylar sulcus broadly open, U-shaped in outline; shaft

<sup>1</sup> *Bubo leptosteus* Marsh, Amer. Journ. Sci., ser. 3, vol. 2, 1871, p. 126 (Bridger Eocene).

broad and flattened both in front and behind, the anterior margin of the inner condyle produced over the shaft in a slight overhang; no supratendinal bridge. Bone strongly fossilized, dull brownish gray in color, somewhat distorted by crushing.

*Measurements*.—Transverse breadth across condyles, 11.5 mm; transverse breadth of lower end of shaft, 8.9 mm.

*Remarks*.—Though in somewhat worn and distorted condition the fragment described above shows so definitely the characters assigned at present to the family Protostrigidae that it was identified as of that group at once on casual preliminary examination.

In general form *Protostrix mimica* is closely similar to *P. leptosteus* as indicated in the diagnosis, smaller size being its main characteristic. The size difference between the types of these two species has been carefully checked with differences existing between



FIGURE 4.—*Protostrix mimica*, new species: Distal end of tibiotarsus (type). Natural size.

male and female in species of modern owls to find that the amount is more than covered by this sexual variation. In addition, the outer condyle is somewhat thicker. Possibly the two belong in separate genera, but with so small a representation of both of the species concerned it is considered best to list them as congeneric.

As *Protostrix saurodosis* (Wetmore) is intermediate in size between the barred and great horned owls, *P. mimica* is decidedly smaller.

In the same locality and horizon Mr. Walker secured the distal end of a right tarsometatarsus (fig. 5) that I consider also to represent the species here described. The specimen (U.S.N.M. no. 14874) is slightly distorted by pressure and has part of the slender processes of the lateral trochlea missing, but it is sufficiently complete to indicate its characters. I have no hesitancy in identifying it as coming from a member of the Protostrigidae, and its dimensions are such as to indicate that it comes from a bird the size of *P. mimica*. It is logical therefore to place it with the species of that family from the same collecting locality.

Following is the detailed description of this fragment: Outer trochlea in lateral outline comparatively broad and rounded, pro-

jecting strongly distally, and set at a distinct angle with the central axis of the shaft (a portion of the posterior projection missing); considerably compressed from side to side, with free margin narrowed; middle trochlea relatively broad and heavy, separated from the external trochlea by a narrow, shallow sulcus; anterior surface merging smoothly with lower end of shaft; articular surface deeply marked on posterior face by a sharply angular groove, the outer margin bounding this groove projecting farther than the inner; axis of trochlea making an oblique angle toward the outside with the axis of the shaft; internal trochlea relatively heavy, projecting rather abruptly beyond the free margin of the shaft; anterior face with a broad, smooth articular surface, and posterior face deeply grooved (outer, free margin missing); outer face with a deep, somewhat irregular pit; separated from the middle trochlea by a shallow, narrow groove; lower end of shaft broad, roundly concave on the anterior face, and broadly grooved behind; a well-marked inferior

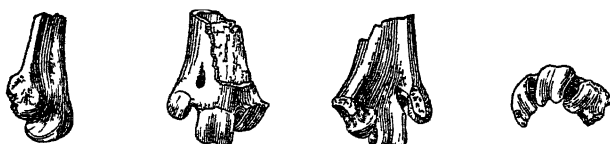


FIGURE 5.—*Protostrix mimica*, new species: Distal end of metatarsus. Natural size.

foramen. Bone dull dark brownish gray in color, well fossilized. Transverse breadth across trochlea 13.2 mm (other pertinent measurements not available).

Compared with living *Strix varia* of the family Strigidae the fossil has the outer trochlea much broader when viewed from the side, the anterior base of the middle trochlea merging smoothly with the base of the shaft instead of projecting abruptly, and the internal trochlea relatively smaller when viewed from in front. It is nearer to the Strigidae in its characters than to the Tytonidae and is sufficiently different to support the separation of *Protostrix* in a distinct family. It will be recalled that to this time the Protostrigidae have been separated on the basis of characters found in the distal end of the tibiotarsus.

Discovery of this new species increases the number now known in the Protostrigidae to four, as follows: *Protostrix lyddekeri* (Shufeldt), *P. leptosteus* (Marsh),<sup>2</sup> *P. saurodosis* (Wetmore), and *P. mimica* Wetmore.

Drawings of the specimens described herein were made for me by Sydney Prentice.

<sup>2</sup>For reference of *Bubo leptosteus* Marsh to this genus, see Wetmore, Condor, 1937, pp. 84-85.



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by the

SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1938

No. 3032

DESCRIPTIONS OF NEW FISHES OBTAINED BY THE  
UNITED STATES BUREAU OF FISHERIES STEAMER  
"ALBATROSS", CHIEFLY IN PHILIPPINE SEAS AND  
ADJACENT WATERS

By HENRY W. FOWLER

WHILE working in the United States National Museum with various groups of fishes representing chiefly the Berycoidei, Lophobranchii, Scombroidei, Loricati, Craniomi, and Eleotridae obtained by the *Albatross*, I ascertained a number of new genera and species. These are described and the species figured in the present paper.

The arrangement of the characters and their computation, formulas, and other data is the same as in previous reports on other sections of the collection. In locality references, the letter "D" preceding a number refers to the *Albatross* dredging station, and the numbers in parentheses, as "(1567.)", refer to parchment tag numbers tied to the specimens.

Family CHLOROPHTHALMIDAE

BATHYSAUOPS, new genus

*Type.*—*Bathysauops malayanus*, new species.

Body elongate, slender, with long tapering tail. Head large, depressed. Snout short, broad. Eye very large, high, with broad deep orbits, mostly in front half of head. Mouth large, inclined, lower jaw well protruded. Maxillary long, inferior, reaches back well below eye and terminally broadly expanded. Dentition of jaws exposed in closed jaws; above an outer band narrowly of very small teeth, then followed by 2 somewhat irregular rows of larger and



longer well-spaced depressible teeth; all upper teeth extend to lower hind end of maxillary expansion; lower jaw with an outer band of teeth similar to those in upper jaw, then well separated and inside a narrow band of inner teeth made up of many very small close-set teeth with a single row of larger, well-spaced, firmly erect teeth; palatine and vomerine band not continuous across latter, with very narrow band or row of short, small, outer teeth and an inner closely following row of much larger, wide-set, strong, erect teeth; no teeth on tongue. Tongue small, flat, free. Nostrils together, posterior greatly larger, nearer eye than snout tip. Bony interorbital narrow, greatly less than eye. Gill opening widely cleft, extends forward opposite nostrils. Gill rakers slender. Pseudobranchiae well developed. Scales very caducous, most all fallen, thin cycloid. Axial series of scale pockets, evidently forming lateral line, greatly larger than others. Scales on caudal base small. Dorsal inserted before middle of depressed pectoral. Adipose fin small, well behind anal base. Caudal moderate. Pectoral long. Ventral inserted little before dorsal origin. Vent midway between depressed ventral tip and anal origin.

Differs from *Bathysauropsis* Regan in its greatly larger eyes, narrower interorbital space, apparently larger scales in the lateral line, and slightly different proportions.

(*Bathysaurus* + *ψ*, appearance.)

**BATHYSAUROPS MALAYANUS, new species**

**FIGURE 6**

Depth 9; head  $3\frac{1}{3}$ , width  $2\frac{1}{8}$ . Snout 4 in head from snout tip; eye 4, subequal with snout, greatly exceeds interorbital; maxillary reaches below hind eye edge, expansion  $2\frac{1}{5}$  in eye, length  $1\frac{3}{4}$  in head from snout tip; interorbital  $5\frac{1}{3}$ , low, nearly level. Gill rakers 5 + 14, lanceolate, which 2 in eye; gill filaments  $\frac{7}{8}$  of gill rakers.

Scales (pockets) 48+ in lateral line; 6 above, 6 below, 20 predorsal forward to occiput. Scales on chest, breast, and belly small. Scales simple, without striae; circuli fine, basal, about 21, obsolete apically.

D. 1, 11, 1, third branched ray  $1\frac{2}{3}$ ? in total head length; adipose fin  $2\frac{1}{5}$  in eye; A. III, 7, 1, second branched ray  $2\frac{2}{5}$  in total head length; caudal  $1\frac{3}{4}$ ?, apparently well emarginate behind; least depth of caudal peduncle 5; pectoral  $1\frac{1}{4}$ , rays 11, 20; ventral rays I, 7, fin  $1\frac{1}{2}$  in total head length.

Dark brown, blackish brown on head, breast, and belly. Inside gill openings blackish. Iris gray black, pupil pale brown. Fins brown to blackish, especially basally.

*Type*.—U.S.N.M. no. 98888. D. 5656. Olang Point, N. 67° W., 14.5 miles (lat. 3°17'40'' S., long. 120°36'45'' E.), Gulf of Boni, Celebes, Dutch East Indies. In 484 fathoms. December 19, 1909. Length 244 mm.

Known only from the type.

(Named for Malaya.)

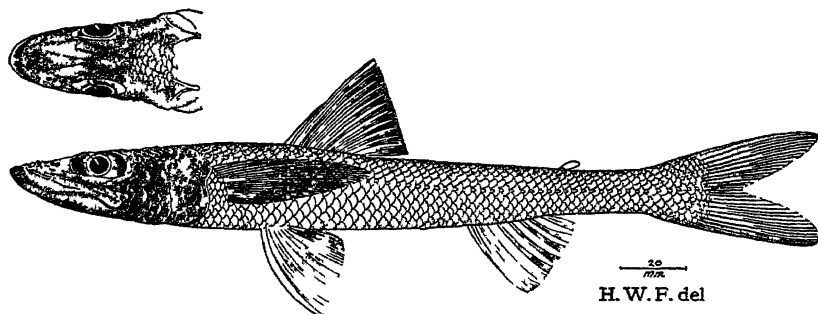


FIGURE 6.—*Bathysaurops malayanus*, new genus, new species Type.

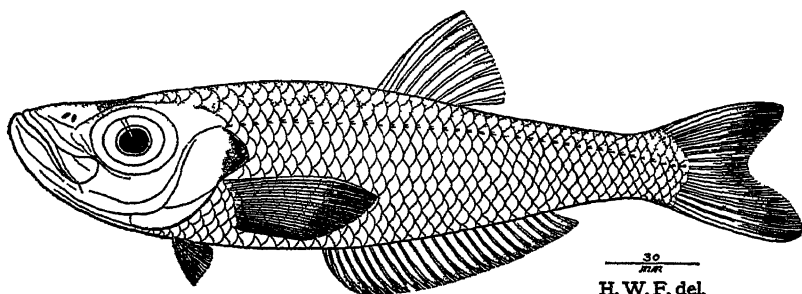


FIGURE 7.—*Bathyclupea megaceps*, new species. Type.

## Family BATHYCLUPEIDAE

### Genus BATHYCLUPEA Alcock

#### BATHYCLUPEA MEGACEPS, new species

#### FIGURE 7

Depth  $3\frac{3}{4}$  to  $4\frac{1}{4}$ ; head  $2\frac{1}{2}$  to  $2\frac{3}{4}$ , width  $2\frac{2}{5}$  to  $2\frac{1}{2}$ . Snout to orbit  $3\frac{2}{3}$  to  $3\frac{3}{4}$  in head from snout tip; orbit  $2\frac{1}{2}$  to  $2\frac{2}{3}$ , greatly exceeds snout or interorbital; eye 3 to  $3\frac{1}{5}$  in head; maxillary reaches  $\frac{1}{8}$  to  $\frac{1}{6}$  in orbit, length  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head from snout tip; teeth in villiform bands above, with outer series uniformly and slightly enlarged; lower teeth single row of small, uniform conic teeth; interorbital  $5\frac{1}{4}$  to  $5\frac{7}{8}$ , low, nearly level. Gill rakers 3+13, lanceolate, 3 in orbit; gill filaments  $\frac{4}{5}$  of gill rakers.

Scales 35 in lateral line to caudal base and 3 more on latter; 3 above, 9 below, 15 predorsal forward to occiput close behind hind eye edge. Scales very thin, caducous, most all fallen except few in lateral line.

D. I, 8, 1, fin origin midway between hind eye edge or pupil and caudal base, first branched ray  $2\frac{2}{5}$  ? to  $2\frac{1}{2}$  in total head length; A. II, 26, 1 or II, 27, 1, fin origin midway between front end of mandible and caudal base, about  $\frac{7}{8}$  to 1 diameter of orbit in advance of dorsal origin, first branched ray  $2\frac{1}{2}$  to  $3\frac{3}{4}$  ? in total head length; caudal (damaged) emarginate; least depth of caudal peduncle 4 to  $4\frac{3}{4}$ ; pectoral  $1\frac{1}{8}$  to  $1\frac{1}{5}$ ; ventral 5 to 6.

Brown generally, little paler below or on under surfaces. Opercles and lower surface of head neutral black. Iris silvery white. Inside mouth and gill opening blackish brown. Fins all light brownish.

*Type*.—U.S.N.M. no. 93323. D. 5507. Camp Overton Light, Iligan Bay (Mindanao), S.  $1^{\circ}$  E., 8.6 miles (lat.  $8^{\circ}21'12''$  N., long.  $124^{\circ}12'06''$  E.), northern Mindanao and vicinity. In 425 fathoms. August 4, 1909. Length 238 mm, caudal tips broken. Also 2 paratypes.

*Remarks*.—Characterized by its very large head and orbital socket. Related to *B. gracilis*, described below, in its advanced anal fin origin, a feature in which it differs at once from *B. malayana* Weber and *B. hoskynii* Alcock.

(μέγας, great + κεφαλή, head.)

#### BATHYCLUPEA GRACILIS, new species

#### FIGURE 8

Depth  $3\frac{3}{4}$  to 4; head 3 to  $3\frac{1}{8}$ , width  $2\frac{1}{8}$  to 3. Snout 3 to 4 in head from snout tip; eye  $2\frac{3}{4}$  to 3, greater than snout in young to subequal with age, greater than interorbital; maxillary reaches to or  $\frac{1}{5}$  in eye, length  $2\frac{1}{4}$  to  $2\frac{1}{3}$  in head from snout tip; interorbital  $4\frac{1}{2}$  to  $5\frac{1}{4}$ , low, level. Gill rakers 2+13, lanceolate, 2 in eye; gill filaments  $\frac{2}{5}$  of gill rakers; 4 more asperous rudimentary gill rakers above and 3 below.

Scales 35 or 36 in lateral line to caudal base and 3 more on latter; 3 above, 8 or 9 below, 14 or 15 predorsal forward opposite hind eye edge. Scales caducous, very thin, most all fallen. Scales with 78 to 80 complete circuli.

D. I, 8, 1 or I, 9, 1, fin origin 1 to  $1\frac{3}{5}$  times eye behind anal origin, first ray  $1\frac{3}{4}$  to 2 in total head length; A. II, 23, 1 to II, 26, 1, first branched ray  $2\frac{2}{5}$  to 3; caudal  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , forked; least depth of caudal peduncle  $3\frac{1}{5}$  to  $3\frac{4}{5}$ ; pectoral  $1\frac{1}{8}$  to  $1\frac{1}{6}$ , rays 1, 26; ventral rays I, 5, fin 3 to  $5\frac{1}{8}$  in total head.

Brown, with silvery to gray tints below. Iris silvery white. Lower side of head silvery white. Fins pale uniform brownish white. Inside gill opening blackish.

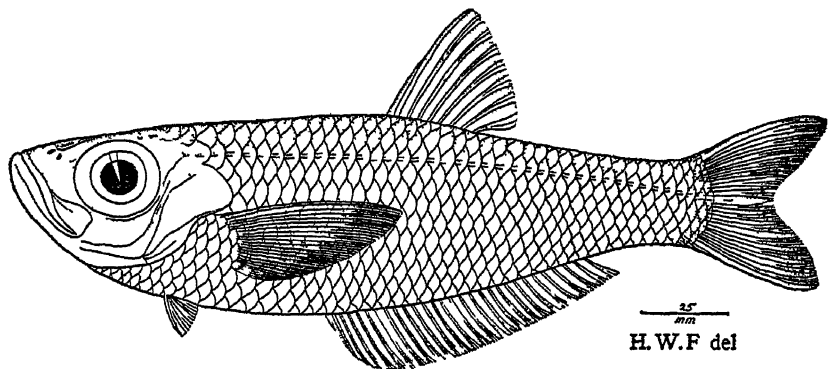


FIGURE 8—*Bathyclupea gracilis*, new species Type

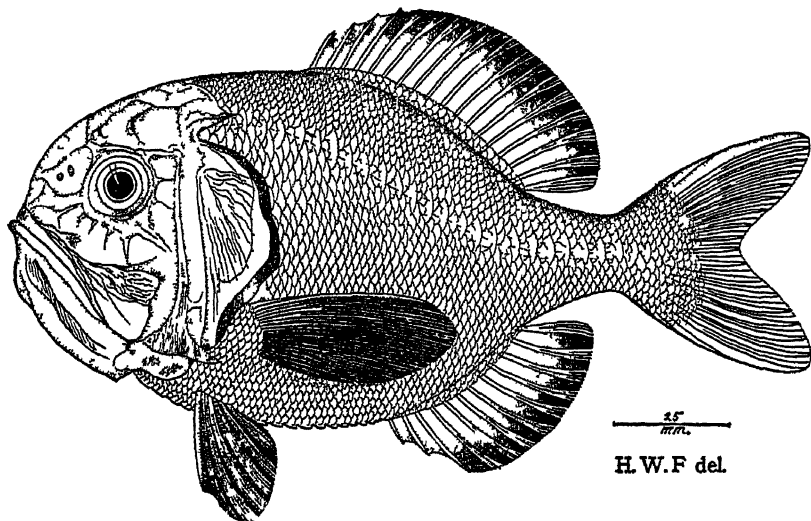


FIGURE 9—*Hoplostethus melanopterus*, new species Type

*Type*—U.S.N.M. no. 93320. D 5622 Makyan Island (NE.), N. 66° W., 4.1 miles (lat. 0°19'20" N., long. 127°28'30" E.). In 275 fathoms. November 29, 1909. Length 230 mm. Also 20 paratypes.

*Remarks*.—Differs from *B. megaceps* in its shorter and smaller head, though with dorsal in similar position. The eye, while larger than usual, is smaller than in *B. megaceps*.

(*gracilis*, slender.)

## Family TRACHICHTHYIDAE

## TRACHICHTHYINAE, new subfamily

Type genus, *Trachichthys* Shaw and Nodder.

Vent normally placed, at least behind ventrals.

Other genera are *Hoplostethus* Valenciennes, *Gephyroberyx* Boulenger, *Leiogaster* Weber, and *Korsogaster* Parr, the last immature.

## Genus HOPLOSTETHUS Valenciennes

## Subgenus HOPLOSTETHUS Valenciennes

Type.—*Hoplostethus mediterraneus* Valenciennes.

Body without silvery lateral tubelike striae on under surfaces.

## HOPLOSTETHUS MELANOPTERUS, new species

## FIGURE 9

Depth  $1\frac{1}{8}$  to 2; head  $2\frac{1}{8}$  to  $2\frac{1}{2}$ , width 2 to  $2\frac{1}{10}$ . Snout,  $3\frac{7}{8}$  to 4 in head from snout tip; eye  $3\frac{3}{4}$  to  $4\frac{1}{8}$ , slightly greater to subequal with snout,  $1\frac{1}{8}$  to  $1\frac{1}{4}$  in interorbital; maxillary extends obliquely down slightly behind eye, expansion  $1\frac{1}{5}$  to  $1\frac{1}{3}$  in eye, length  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in head from snout tip; interorbital  $3\frac{1}{5}$  to  $3\frac{1}{3}$ , well elevated, convex; nasalia minute, close set, directed downward anteriorly. Gill rakers 7+16, lanceolate,  $1\frac{1}{4}$  in eye; gill filaments  $\frac{2}{5}$  gill rakers.

Scales 65 close along and above lateral line to caudal base and 4 more on latter; pores 27 or 28 in lateral line to caudal base; 12 or 13 scales above lateral line, 27 below, 26 predorsal forward opposite hind eye edge, 4 behind hind maxillary edge on cheek. Abdominal serrae 11 to 13. Scales with 15 to 18 parallel basal circuli; 9 to 18 wide set, short, strong, apical denticles, 3 to 7 transversely and with age medial largest.

D. IV or V, 13, 1 or 14, 1, last spine 3 to  $3\frac{1}{8}$  in total head length, third ray  $2\frac{1}{4}$  to  $2\frac{1}{3}$ ; A. III, 10, 1, third spine  $3\frac{4}{5}$  to  $4\frac{1}{8}$ , second ray  $2\frac{1}{2}$  ? to  $2\frac{7}{8}$  ?; caudal  $1\frac{1}{10}$ , well forked; least depth of caudal peduncle  $3\frac{7}{8}$  to 4; pectoral  $1\frac{1}{8}$  to  $1\frac{1}{6}$ ; ventral  $1\frac{1}{4}$  to 2.

Brown, with coppery sheen, especially over squamous areas. Iris pale gray to coppery. Inside gill opening dusky. Vertical fins very pale or light brown. Paired fins dark or blackish brown.

Type.—U.S.N.M. no. 93329. D. 5373. Tayabas Light (outer), N. 20°E., 15 miles (lat. 13°40' N., long. 121°31'10'' E.), Marinduque Island and vicinity. In 338 fathoms. March 2, 1909. Length 170 mm. Also 46 paratypes.

Known by its dark to blackish paired fins.

(μῆλας, black + πτερύον, fin.)

## AULOHOPISTETHUS, new subgenus

*Type.*—*Hoplostethus metallicus*, new species.

Silvery lateral tubelike striate areas on chest, breast, prepectoral region, and along abdominal edge.

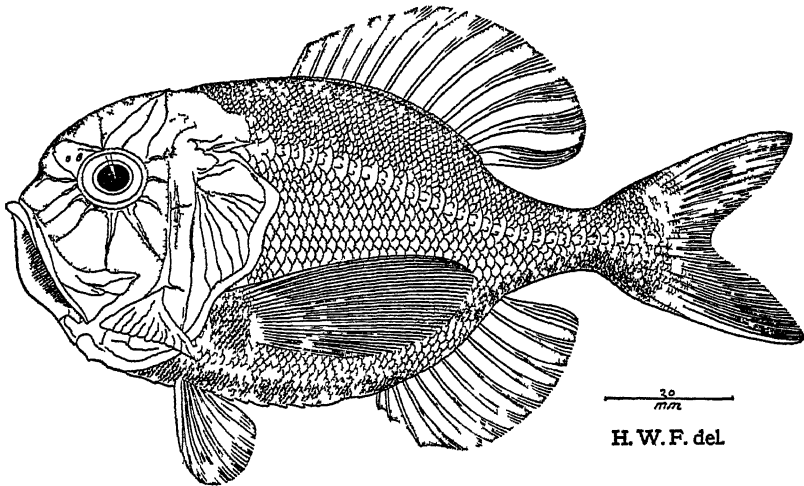
Differs from subgenus *Hoplostethus* in the silvery lateral tubelike striate areas.

(αὐλός, tube + *Hoplostethus*.)

## HOPLOSTETHUS METALLICUS, new species

FIGURE 10

Depth  $1\frac{1}{10}$  to 2; head  $2\frac{1}{3}$  to  $2\frac{2}{5}$ , width  $1\frac{1}{10}$  to  $2\frac{1}{5}$ . Snout 4 to  $4\frac{1}{2}$  in head from snout tip; eye 3 to  $3\frac{1}{3}$ , greater than snout, equals interorbital; maxillary oblique, reaches opposite hind eye edge; expansion  $1\frac{1}{5}$  to  $1\frac{1}{4}$  in eye, length  $1\frac{2}{5}$  in head from snout tip; teeth in villiform bands in jaws and on palatines, none on vomer; interorbital  $3\frac{1}{3}$  to  $3\frac{2}{5}$ , convex; nasalia minute, close set, directed downward. Gill rakers 8+16, lanceolate, twice gill filaments or  $1\frac{1}{2}$  in eye.

FIGURE 10—*Hoplostethus metallicus*, new species Type.

Scales 70 close along above lateral line to caudal base and 4 more on latter; pores 29; 13 scales above, 22 below, 28 predorsal forward nearly opposite hind eye edge, 6 behind maxillary expansion. Abdominal serrae 5 or 6. Chest, breast, prepectoral area, narrow strip from above ventral base along each side of abdominal or postventral serrae to anal fin origin, silvery gray area, with very fine parallel close-set dark lines whole extent; similar area begins well above anal origin on lower side of tail and extends back along lower or under surface

of caudal peduncle to lower rudimentary caudal rays. Similar silvery areas along each outer face of mandible, on chin and walls of isthmus. Scales with 10 to 18 basal parallel striae; 8 or 9 small, short, apical denticles, with 4 or 5 transverse series.

D. V, 13, 1, fifth spine  $2\frac{3}{4}$  to  $3\frac{1}{5}$  in total head length, second branched ray  $2\frac{1}{5}$  to  $2\frac{1}{2}$ ; A. III, 8, 1 or III, 9, 1, third spine  $3\frac{1}{8}$  to  $3\frac{7}{8}$ , first branched ray  $2\frac{1}{2}$ ? to 3; caudal 1 to  $1\frac{1}{10}$ , deeply forked, lobes slender, pointed; least depth of caudal peduncle  $4\frac{1}{2}$  to  $4\frac{4}{5}$ ; pectoral  $1\frac{1}{10}$  to  $1\frac{1}{5}$ ; ventral  $1\frac{3}{5}$  to 2.

Dark gray-brown, with shining metallic dusky sheen. Iris grayish to dusky or silvery. Inside gill opening dusky to blackish. Fins pale to whitish, caudal lobes medially and upper pectoral rays dusky.

*Type*.—U.S.N.M. no. 93344. D. 5189. Pescador Island, N.  $72^{\circ}$  E., 3.3 miles (lat.  $9^{\circ}56'30''$  N., long.  $123^{\circ}15'$  E.), Tanon Strait, east coast of Negros, Philippine Islands. In 300 fathoms. April 1, 1908. Length 123 mm. Also a series of Philippine paratypes.

*Remarks*.—Differs from related species in the delicate narrow osseous compartments enclosing the cavernous areas of the head, dark coloration, few abdominal serratures and peculiar metallic finely striated grayish areas, likely luminous areas.

(*metallicus*, like metal.)

#### Genus GEPHYROBERYX Boulenger

##### GEPHYROBERYX PHILIPPINUS, new species

#### FIGURE 11

Depth 2 to  $2\frac{1}{8}$ ; head  $2\frac{1}{3}$  to  $2\frac{2}{5}$ , width  $2\frac{1}{4}$  to  $2\frac{3}{5}$ . Snout 4 to  $4\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{8}$  to 4, equal to or greater than snout, subequal with interorbital; maxillary very oblique, reaches opposite hind eye edge or slightly beyond, expansion  $1\frac{2}{5}$  to 3 in eye, length  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in head from snout tip; interorbital  $3\frac{2}{3}$  to  $3\frac{7}{8}$ , broadly convex, rather low; nasalia short, directed forward. Gill rakers 6+15, lanceolate, twice gill filaments or  $1\frac{2}{5}$  in eye.

Scales 70 close along and above lateral line to caudal base and 4 or 5 more on latter; pores 27 in lateral line to caudal base and 3 more on latter; 18 above, 19 below, predorsal 20; 6 rows behind hind expansion of maxillary. Abdominal serrae 8 to 10. Scales with 13 or 14 basal parallel striae; 22 or 23 slender pointed apical denticles, 3 or 4 rows irregularly transverse.

D. VIII, 13, 1 or 14, 1, fourth spine  $2\frac{7}{8}$  to 3 in total head length, second branched ray 2 to  $2\frac{1}{8}$ ; A. III, 10, 1 or 11, 1, third spine  $3\frac{7}{8}$  to 4, second branched ray  $2\frac{1}{4}$  to  $2\frac{1}{3}$ ; caudal  $1\frac{1}{4}$  to  $1\frac{1}{3}$ , forked; least depth of caudal peduncle 5 to  $5\frac{1}{5}$ ; pectoral  $1\frac{3}{5}$  to  $1\frac{2}{3}$ ; ventral  $1\frac{4}{5}$  to 2.

Back brown, lower surfaces slightly paler and with silvery white sheen. Iris pale or silvery white. Fins all pale or with yellow to dull orange tints.

*Type*.—U.S.N.M. no. 93345. D. 5516. Point Tagolo Light (Mindanao), S. 8° W., 9.7 miles (lat. 8°46' N., long. 123°32'30" E.), northern Mindanao and vicinity, Philippine Islands. In 175 fathoms. August 9, 1909. Length 155 mm. Also a series of Philippine examples, paratypes.

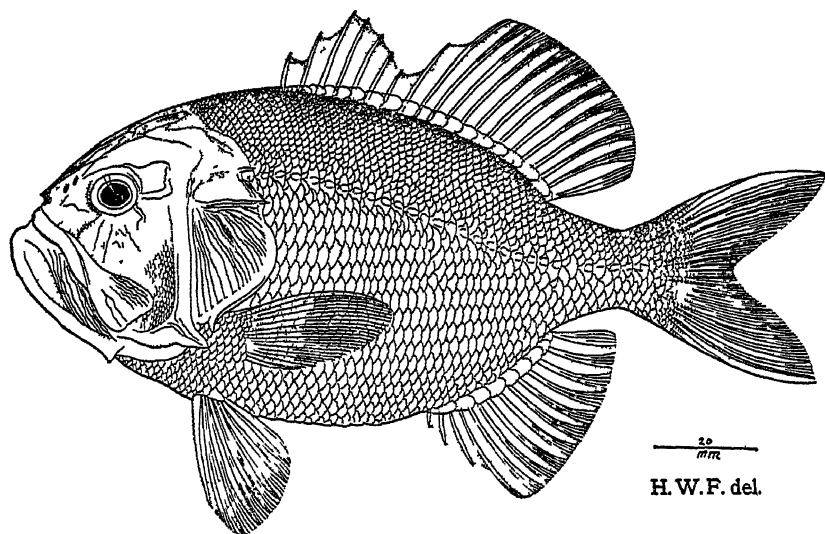


FIGURE 11—*Gephyroberyx philippinus*, new species. Type

*Remarks*.—East Indies, Philippines. Related to *Gephyroberyx japonicus* (Steindachner and Döderlein) from Japan but differing in the few (8–10) abdominal scutes, always about 14 in the Japanese species. It also approaches *G. darwini* (Johnson) from Madeira in the few (10) abdominal scutes, but that species is described with 12 branched anal rays, while my species has but 10 or 11. Moreover *G. darwini* is said to have depth  $2\frac{1}{3}$ . *Trachichthys darwini* of Alcock, 1899, from off Trincomale, and of Barnard, 1925, from Natal, may also be confused with the present species.

(Named for the Philippines.)

#### Subfamily PARATRACHICHTHYINAE

Vent more advanced, close behind ventral bases. Abdominal serrae behind vent.



Genus *PARATRACHICHTHYS* Waite

## ANALYSIS OF SPECIES

$\alpha^1$ . *AULOTRACHICHTHYS*, new subgenus. Subcutaneous silvery-gray striated tubes and areas along lower surface of body.

$\delta^1$ . Depth  $2\frac{1}{4}$  to  $2\frac{3}{5}$ ; gill rakers 6+10..... *latus*.

$\delta^2$ . Depth  $2\frac{1}{2}$ ; gill rakers 6+15..... *prosthemiis*.

$\alpha^2$ . *PARATRACHICHTHYS*. No subcutaneous tubes or areas along lower surface of body; depth  $2\frac{1}{2}$ ; gill rakers 9+18..... *traillii*.

*AULOTRACHICHTHYS*, new subgenus

*Type*.—*Paratrachichthys latus*, new species.

Differs from subgenus *Paratrachichthys* in the presence of the subcutaneous silvery-gray striated tubes and areas along lower surface of body. Includes *Paratrachichthys latus* and *P. prosthemiis*.

(αὐλός, tube + *Trachichthys*.)

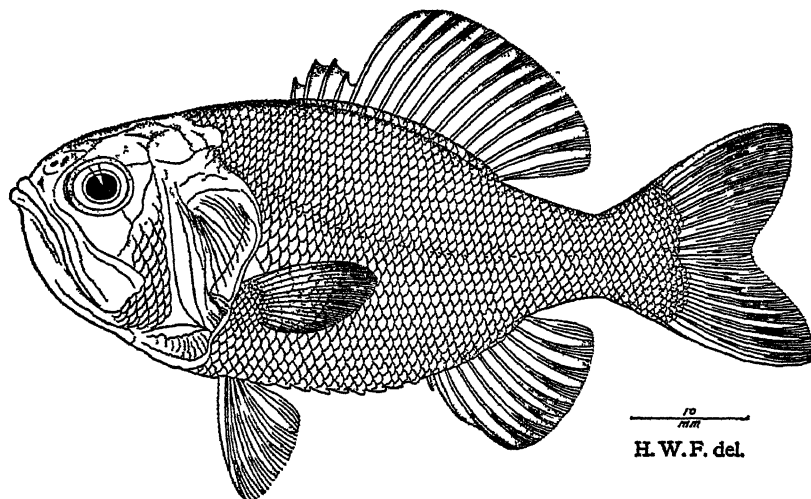


FIGURE 12.—*Paratrachichthys latus*, new species. *Type*.

*PARATRACHICHTHYS LATUS*, new species

## FIGURE 12

Depth  $2\frac{1}{4}$  to  $2\frac{3}{5}$ ; head  $2\frac{2}{5}$  to  $3\frac{3}{5}$ , width 2 to  $2\frac{1}{6}$ . Snout  $4\frac{2}{3}$  to  $4\frac{7}{8}$  in head from snout tip; eye  $3\frac{1}{2}$  to  $3\frac{3}{4}$ , greater than snout or interorbital; maxillary greatly inclined, reaches slightly beyond hind eye edge, expansion  $1\frac{1}{8}$  to  $1\frac{1}{3}$  in eye, length  $1\frac{2}{5}$  in head from snout tip; bands of villiform teeth in jaws and on palatines, none on vomer; interorbital  $3\frac{7}{8}$  to  $4\frac{1}{2}$  in head from snout tip, low, broadly convex. Gill rakers 6+10, lanceolate, twice gill filaments or  $1\frac{1}{4}$  in eye.

Scales 58 in medial or lateral axial series; lateral line imperfectly defined, seldom complete; 27 scales transversely at anal origin; 23 predorsal forward opposite hind eye edge. Cheek scaled largely posteriorly, 6 rows behind maxillary expansion. Abdominal scutes 7 to 9. Scales with 12 to 16 basal circuli; apical denticles 10 or 11, scattered, 5 transversely, rather large simple points. Chin, walls of isthmus, chest, breast, region around vent and band along abdominal scutes and above anal base of silvery-gray striated pigment, also space before pectoral base.

D. IV, 1 or III, 15, 1, last spine 4 to 5 in total head length, fifth ray 2 to  $2\frac{1}{3}$ ; A. II, 9, 1, second spine  $5\frac{2}{5}$ , second ray  $2\frac{1}{5}$  to  $2\frac{3}{4}$ ; caudal  $1\frac{1}{5}$  to  $1\frac{2}{5}$ , deeply forked; least depth of caudal peduncle 3 to  $3\frac{1}{4}$ ; pectoral  $1\frac{3}{5}$  to  $1\frac{4}{5}$ ; ventral  $1\frac{4}{5}$  to 2.

Body brown generally, slightly lighter or with more gray tinge below, also shining reflections of silver gray. Iris silver-gray. Inside gill opening silver-gray. Fins pale to whitish.

*Type*.—U.S.N.M. no. 93346. (2507.) Philippines. Length 70 mm. Also a series of Philippine examples, paratypes.

*Remarks*.—Philippine Islands. Related to *Paratrachichthys prosthemi* especially in its gray subcutaneous tubular striated areas and scutes. It differs, however, in fin formula, gill rakers, proportions, etc. Bathymetrical range 90 to 395 fathoms.

(*latus*, broad.)

## Family SYNGNATHIDAE

### Genus DUNCKEROCAMPUS Whitley

#### DUNCKEROCAMPUS PESSULIFERUS, new species

#### FIGURE 13

Depth  $20\frac{1}{3}$ , 17 to vent; head  $3\frac{1}{6}$ ,  $3\frac{4}{5}$  to caudal base, width 7 in its length. Snout  $1\frac{2}{5}$  in head from snout tip; eye 9,  $6\frac{1}{4}$  in snout, greatly exceeds interorbital; maxillary  $\frac{3}{5}$  of eye; interorbital  $1\frac{1}{2}$ , concave. Opercle with imperfect or feeble keel anteriorly, oblique, extends  $\frac{2}{3}$  of bone.

Rings 19+20, caudal section  $\frac{4}{5}$  of trunk. Upper trunk keel discontinuous with upper caudal keel, both overlapping whole length of dorsal fin; lower trunk keel discontinuous with lower caudal keel; median lateral trunk keel continuous with lower caudal keel; median ventral trunk keel distinct, discontinuous at vent. Snout with upper ridges, orbital ridges, and mandibular ridges serrate. Each ridge of body with spine posteriorly, distinct and protruding.

D. 26, on 3+4 rings, fin height  $1\frac{1}{5}$  in eye; A.  $2\frac{1}{2}$ , fin length 2 in eye; caudal 3 in total head length, ends in median point behind; pectoral rays 19, fin length equals eye.

Light brown, nearly uniform. Just before interorbital 3 dark brown transverse bars, 1 across interorbital, and 6 on postocular region of head; middle of each trunk ring with dark brown transverse bar, also one at each articulation; for extent of dorsal fin only dark transverse brown bar at each articulation; on tail otherwise rings marked like trunk. Iris slate. Fins uniformly brown.

*Type*.—U.S.N.M. no. 93501. D. 5146. Sulade Island (E.), N. 18° W., 3.4 miles (lat. 5°46'40" N., long. 120°48'50" E.), Sulu Archipelago, vicinity of Siasi. In 24 fathoms. February 16, 1908. Length 110 mm.



FIGURE 13.—*Dunckerocampus pessuliferus*, new species Type.



FIGURE 14.—*Syngnathus micronotopterus*, new species Type

*Remarks*.—Related to *Dunckerocampus dactyliphorus* (Bleeker), of which I have 4 Philippine examples, ranging from smaller to larger than the species here described. As shown by Weber and Beaufort's figure, the dark bars are alternately present on the various rings. Also the snout is with dark transverse bars and the subdorsal rings only 1+3 or 4.

(*pessulum*, little bar+*fero*, to bear; with reference to coloration.)

### Genus SYNGNATHUS Linnaeus

#### SYNGNATHUS MICRONOTOPTERUS, new species

FIGURE 14

Depth  $16\frac{2}{3}$  to  $17\frac{2}{3}$ ; head 7 to  $8\frac{1}{8}$ , width  $2\frac{3}{5}$  to  $2\frac{1}{2}$ . Snout  $2\frac{1}{2}$  to  $2\frac{4}{5}$  in head; eye  $4\frac{7}{8}$  to  $5\frac{2}{5}$ ,  $1\frac{7}{8}$  in snout, greatly exceeds interorbital; interorbital 2 in eye; opercular keel about over first or basal half, radiating striae very fine minute, close set.

Rings 15 to 16+28 to 30; rings transversely striated. Upper trunk keel reaches first or second caudal ring, discontinuous with upper caudal keel, which begins on upper part of last trunk ring; median lateral trunk keel deflected posteriorly and continuous with lower caudal keel; lower trunk keel subcontinuous or discontinuous with lower caudal keel. Brood pouch on 11 caudal keels.

D. 16 to 18, on 1 trunk and 3 caudal rings, fin height  $1\frac{7}{8}$  to 2 in total head; A. minute; caudal  $4\frac{1}{5}$ ; pectoral  $4\frac{1}{3}$  to 5, rays 10.

Male largely uniform brown, scarcely paler below. Above median lateral keel of trunk 3 blackish equidistant blotches. Brood pouch neutral black. Fins all brownish.

Female light brown, lower surface little paler, though more or less mottled. Eleven blackish-brown transverse bars on back, each followed by small, gray-white, rounded, well-contrasted spot. Three dark-brown bars across lower side of snout, one obliquely back from lower eye edge and another broadly from lower postocular. Dark brown band from upper postocular widens and extends ill defined toward occiput. Iris dark gray. At junction of each ring on upper and lower body edges dark brown spot. Fins pale, caudal with dark transverse bar.

*Type*.—U.S.N.M. no. 94082. Canimo Island near Daet Point, Luzon, Philippine Islands. June 15, 1909. Length 56 mm.

Also a series of paratypes from the Philippines and the East Indies.

*Remarks*.—East Indies, Philippines. This species is characterized by its short opercular keel only developed anteriorly, few dorsal rays, and its variegated coloration. It resembles *Halicampus koilomatodon* (Bleeker) but is without the spines and strongly keeled rough rings of that species.

(μικρός, small + νῶτος, back + πτερόν, fin.)

### Genus ICHTHYOCAMPUS Kaup

#### ICHTHYOCAMPUS PHILIPPINUS, new species

Depth  $17\frac{1}{3}$ ; head 7, width  $3\frac{1}{2}$ . Snout  $2\frac{1}{3}$  in head from snout tip; eye  $5\frac{1}{3}$ ,  $2\frac{1}{3}$  in snout, greatly exceeds interorbital; low median keel on snout above to interorbital; occipital-nuchal keel short, low, not on first trunk ring; narrow interorbital half of eye, shallowly concave; opercle with low short basal keel anteriorly, with many fine radiating striae.

Rings 17+32; with very fine, minute transverse striae; keels low, smooth. Upper trunk and caudal keels continuous; median lateral trunk keel not extended on first caudal keel; lower trunk and caudal keels continuous; median ventral trunk keel distinct to vent.

D. 17, on 1 trunk and 4 caudal rings, base not elevated, height  $1\frac{4}{5}$  in eye; A.  $1\frac{1}{3}$  in eye; caudal  $4\frac{1}{2}$  in head; pectoral  $5\frac{3}{5}$ , rays 12?

Brown, more or less uniform, head little paler. Iris slate. Fins all pale.

*Type*.—U.S.N.M. no. 94080. D. 5160. Tinakta Island (N.), S. 72° W., 2.75 miles (lat. 5°12'40" N., long. 119°55'10" E.), Sulu Archipelago. In 12 fathoms. February 22, 1908. Length 55 mm.

*Remarks*.—Closely related to *Ichthyocampus erythraeus* Gilbert, but differs in its shorter and more robust snout, eyes directed more or less superiorly, median lateral trunk keel not extending on the first caudal ring and fewer dorsal rays.

(Named for the Philippines.)

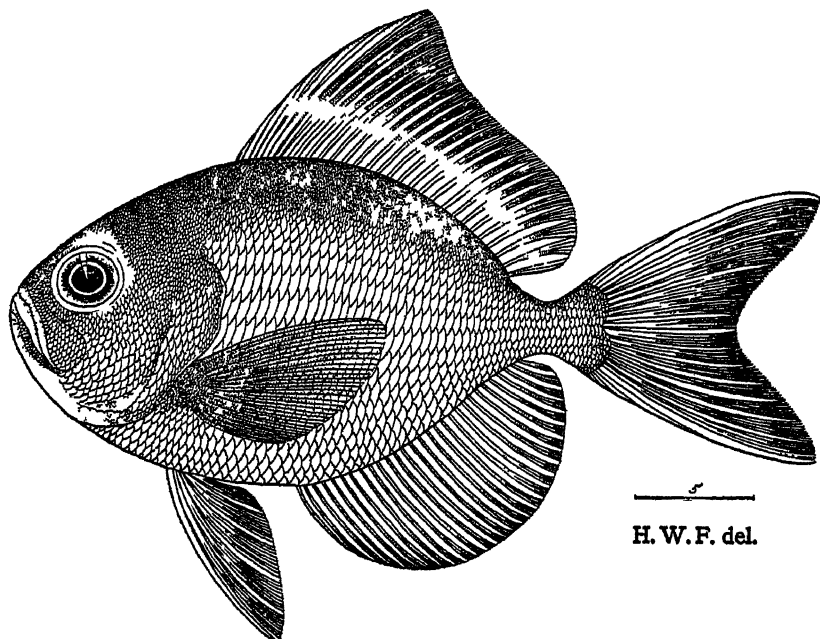


FIGURE 15 —*Brama leucotaenia*, new species. Type

## Family BRAMIDAE

### Genus BRAMA Schneider

#### BRAMA LEUCOTAENIA, new species

FIGURE 15

Depth  $1\frac{3}{4}$ ; head  $2\frac{3}{4}$ , width  $1\frac{3}{4}$ . Snout  $4\frac{1}{4}$  in head from snout tip; eye  $2\frac{1}{2}$ , twice snout, little greater than interorbital; maxillary reaches  $\frac{1}{3}$  in eye, expansion  $\frac{1}{2}$  of eye, length 2 in head from snout tip; interorbital  $2\frac{1}{2}$ , low, convex; preopercle edge with rather large serrae. Gill rakers 4+10, lanceolate,  $\frac{1}{3}$  of gill filaments, which  $1\frac{3}{4}$  in eye.

Scales 55 in lateral line to caudal base; 10 above, 15 below, 23 predorsal forward opposite hind pupil edge; 10 below across cheek.

Scales on middle of sides very narrowly imbricated, with median horizontal keel. Interorbital, snout, and mandible scaleless. Fins not scaly.

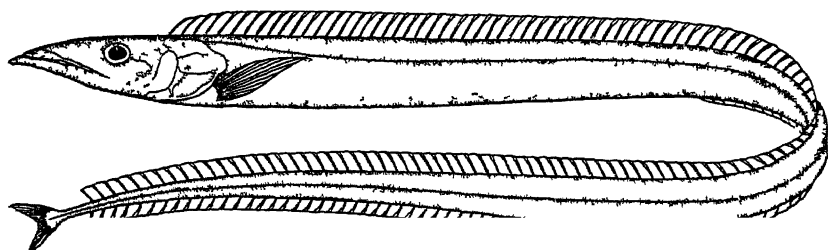
D. III, 26, fin height anteriorly  $1\frac{1}{8}$  in total head; A. 27, fin height  $1\frac{1}{4}$ ; least depth of caudal peduncle 4; pectoral 1, rays 1, 16; ventral I, 5, fin  $1\frac{1}{8}$  in total head.

Brown on back, sides and below with dull brassy tint. Iris brownish. Fins all more or less brownish and dorsals with a longitudinal subbasal pale though distinctly evenly defined pale or light band its whole extent.

*Type*.—U.S.N.M. no. 98817. D. 5134. Balukbaluk Island (N.) S.  $59^{\circ}$  W., 6.25 miles (lat.  $6^{\circ}44'45''$  N., long.  $121^{\circ}48'$  E.), Sulu Archipelago, near Basilan Island, Philippines. February 7, 1908. In 25 fathoms. Length 32 mm.

*Remarks*.—Known only from the above described young specimen, which differs from *Brama raii* (Bloch) in the presence of the pale subbasal longitudinal band on the dorsals. Lütken figures slightly larger and smaller specimens (*Spolia Atlantica*, 1880, pl. 4, figs. 1, 2), though they have their fins uniformly colored. My drawing does not show the lower scales of the tail quite so contrasted in their convergence as seen on the type specimen.

(λευκός, white+ταβία, ribbon; with reference to the white band on the dorsal fin.)



H.W.F. del.

FIGURE 16.—*Benthodesmus benjamini*, new species. Type.

## FAMILY LEPIDOPIDAE

### Genus BENTHODESMUS Goode and Bean

#### BENTHODESMUS BENJAMINI, new species

FIGURE 16

Depth 21 to  $21\frac{2}{3}$ ; head  $6\frac{2}{3}$  to  $7\frac{1}{2}$ , width  $5\frac{1}{3}$  to 6. Snout  $2\frac{1}{6}$  to  $2\frac{1}{5}$  in head from snout tip; eye  $6\frac{4}{5}$  to  $8\frac{4}{5}$ , 3 to 4 in snout,  $\frac{1}{10}$  in interorbital in young to greater than interorbital with age; maxillary

reaches eye, expansion  $1\frac{1}{2}$  to 2 in eye, length  $2\frac{1}{5}$  to  $2\frac{2}{5}$  in head from snout tip; 4 large upper front canines, followed by 5 or 6 smaller wide set teeth each side; 8 or 9 wide set teeth each side below, first one of which well inclined back and not enlarged; row of small slender teeth on each palatine; interorbital  $6\frac{1}{4}$  to 9, rather low, level. Gill rakers as 2+7, low, short, feeble denticles, barely  $\frac{1}{4}$  of gill filaments, which  $1\frac{3}{4}$  in eye.

No scales. Lateral line complete, axial along side of body.

D. 115 to 122, fin height 7 in total head length; A. 74, lower than dorsal; caudal 6 to  $6\frac{1}{4}$ ? (damaged); least depth of caudal peduncle  $2\frac{1}{2}$  to 5 in eye; pectoral  $2\frac{2}{5}$  to 3 in head, rays 12; ventral small pair of rudimentary scalelike flaps opposite pectoral origin on median line of belly, about  $\frac{1}{3}$  of eye.

Gray or leaden, where skin rubbed off brown. Iris gray. Inside mouth and gill opening blackish gray. Fins pale.

*Type*.—U.S.N.M. no. 98821. D. 5445. Atalaya Point, Batag Island, S. 56° E., 5.3 miles (lat. 12°44'42" N., long. 124°59'50" E.), east coast of Luzon, Philippines. In 383 fathoms. June 3, 1909. Length 632 mm. Also a series of 4 paratypes from deep water in the Philippines and East Indies.

(Named for Dr. Marcus Benjamin (1857–1932), efficient editor during many years of the publications of the United States National Museum.)

## - Family CARANGIDAE

### Genus ALEPES Swainson

#### BRANCHIALEPES, new subgenus

*Type*.—*Selar tabulae* Barnard.

Differs from the subgenera *Alepes* Swainson and *Atule* Jordan and Jordan in the increased lower gill rakers 50, compared with 19 to 32 for the former two divisions. Also has well developed posterior adipose eyelids.

(*Βράρχιον*, gill + *Alepes*, with reference to the numerous lower gill rakers.)

### Genus URASPIS Bleeker

#### URASPIS PECTORALIS, new species

#### FIGURE 17

Depth  $2\frac{1}{3}$ ; head  $2\frac{7}{8}$ , width  $2\frac{1}{8}$ . Snout  $2\frac{7}{8}$  in head from snout tip; eye  $3\frac{1}{5}$ ,  $1\frac{1}{5}$  in snout,  $1\frac{1}{5}$  in interorbital; orbit 3, equals snout; maxillary reaches  $\frac{1}{8}$  in eye, expansion 2 in eye, length  $2\frac{1}{3}$  in head from snout tip; teeth uniserial in jaws, absent from palate or tongue;

interorbital 3, convexly elevated, with median ridge extending to dorsal. Gill rakers 4+13, lanceolate, equal gill filaments, which  $1\frac{3}{4}$  in eye.

Scales 52+36 in lateral line, straight section  $1\frac{1}{8}$  in low arch; 20 above arch to soft dorsal origin, 40 below. Breast and chest naked to pectoral base and behind ventral bases. Fins not scaly, only scaly sheaths at bases of soft dorsal and anal. Caudal base scaly. Very few scales on cheek, only few close to infraorbitals and about post-ocular. Scute, depth  $3\frac{3}{4}$  in eye.

D. VIII-I, 24, 1, second spine  $6\frac{1}{4}$  in total head, first branched ray  $2\frac{1}{10}$ ; A. II-I, 20, 1, first branched ray  $2\frac{1}{2}$ ; least depth of caudal peduncle  $6\frac{1}{2}$ ; caudal  $1\frac{1}{5}$ ?, forked; ventral  $2\frac{3}{4}$ , reaches  $1\frac{4}{5}$  to anal; pectoral  $2\frac{4}{5}$  in fish without caudal, rays II, 21, reaches  $\frac{1}{7}$  in straight section of lateral line.

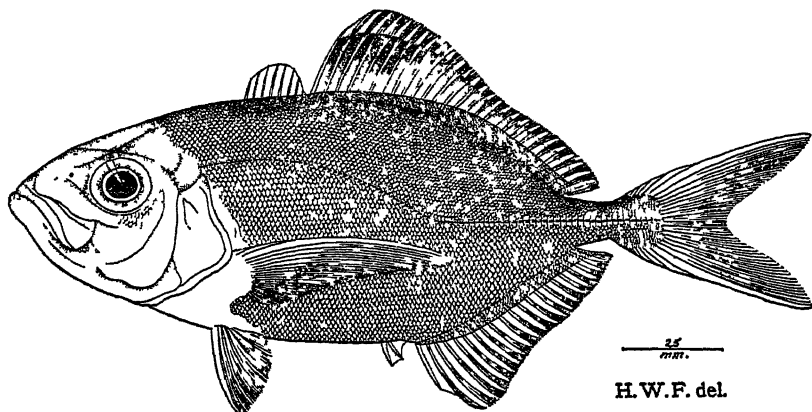


FIGURE 17.—*Uraspis pectoralis*, new species. Type.

Gray above, silvery white below. Iris pale. Mouth inside black, roof and tongue white. Fins brownish.

*Type*.—U.S.N.M. no. 98820. (6328.) Manila Market, Philippine Islands. July 11, 1908. Length 215 mm.

Distinguished chiefly by the long pectorals.  
(*pectoralis*, with reference to its pectorals.)

## FAMILY CIRRHITIDAE

### ANALYSIS OF GENERA

*a*<sup>1</sup>. CIRRHITINAE. Head small, jaws not greatly extended in front.

*b*<sup>1</sup>. Upper profile with deep notch, or incurved over eye; preopercle sharply serrate.

*c*<sup>1</sup>. Soft dorsal rays 12 or 13..... *Cirrhichthys*

*c*<sup>2</sup>. Soft dorsal rays 16 or 17..... *Cyprinocirrhites*



- b*<sup>2</sup>. Upper profile convex, with head deep and mouth low.  
*d*<sup>1</sup>. Scales cycloid, or nearly so.  
*e*<sup>1</sup>. Palatines with teeth anteriorly..... **Cirrhitus**  
*e*<sup>2</sup>. Palatines toothless.  
*f*<sup>1</sup>. Dorsal origin nearly over hind edge of preopercle;  
 canines obsolete..... **Amblycirrhitus**  
*f*<sup>2</sup>. Dorsal origin over pectoral base; canines in both  
 jaws..... **Paracirrhitus**  
*d*<sup>2</sup>. Scales large, rough ctenoid; cheeks with large scales;  
 canines small; palatines with teeth..... **Isobuna**  
*b*<sup>3</sup>. Upper profile well inclined; straight or only slightly convex,  
 muzzle pointed, moderate and mouth terminal.  
*g*<sup>1</sup>. Dorsal spines not half of body depth; scales in 5 or 6  
 rows on cheek..... **Cirrhitoides**  
*g*<sup>2</sup>. Fourth dorsal spine nearly as high as greatest body  
 depth; scales in 4 rows on cheek..... **Acanthocirrhitus**  
*a*<sup>2</sup>. **OXYCIRRHITINÆ**. Head elongated, with long, extended snout;  
 premaxillaries with hind extensions toothed..... **Oxycirrhitus**

### Subfamily CIRRHITINÆ

#### Genus CIRRHITICHTHYS Bleeker

##### CIRRHITICHTHYS ANALIS, new species

#### FIGURE 18

Depth  $2\frac{3}{4}$ ; head  $2\frac{4}{5}$ , width 2. Snout  $3\frac{1}{5}$  in head; eye 3, very slightly exceeds snout, greatly exceeds interorbital; maxillary reaches front eye edge, expansion  $2\frac{4}{5}$  in eye, length 3 in head; teeth in villiform bands in jaws, wider anteriorly, outer slightly enlarged but more so below where 2 or 3 rather large canines form on middle of each mandibular ramus; narrow band of fine teeth on each palatine and vomer; interorbital  $5\frac{2}{3}$ , concave; preopercle edge with 18 rather large denticles. Gill rakers 5+10, lanceolate;  $\frac{1}{2}$  of gill filaments, which  $1\frac{3}{4}$  in eye.

Scales 36+3 in lateral line; 4 above, 10 below, 7 predorsal forward opposite hind eye edge; 4 rows on cheek below eye. Fins all scaly basally. Suprascapula with 8 denticles. Lateral line extends little high at first along side of caudal peduncle and becomes median at caudal base. Scales with 10 radiating basal striae; circuli fine, minute, not extended apically.

D. X, 12, 1, third spine 2 in head, first branched ray  $1\frac{1}{2}$ ; A. III, 6, 1, second spine  $1\frac{1}{2}$ , first ray  $1\frac{2}{3}$ ; caudal  $1\frac{1}{4}$ , truncate; least depth of caudal peduncle 3; pectoral 1, rays 1, 7, vi, membranes of lowest or simple rays deeply incised; ventral rays I, 5, fin  $1\frac{3}{5}$  in head.

Pale brown generally, fins more or less whitish. Iris pale gray. Spinous dorsal with edges of eighth and ninth membranes broadly black. Scattered black spots, less than pupil, on soft dorsal. Small blackish brown spots on predorsal anteriorly and posterior part of

interorbital. Small black spot above suprascapula and another on upper front part of opercle.

*Type*.—U.S.N.M. no. 98901. (22124.) D. 5145. Jolo Light, S. 16° E., 0.85 mile (lat. 6°4'30" N., long. 120°59'30" E.), vicinity of Jolo. In 23 fathoms. February 15, 1908. Length 69 mm.

*Remarks*.—Only the type known. Greatly like *Cirrhitopsis aureus* (Schlegel), but differing chiefly in the longer second anal spine and distinct or contrasted dark to blackish spots on the head and dorsal fin.

(*analis*, with reference to the anal spines.)

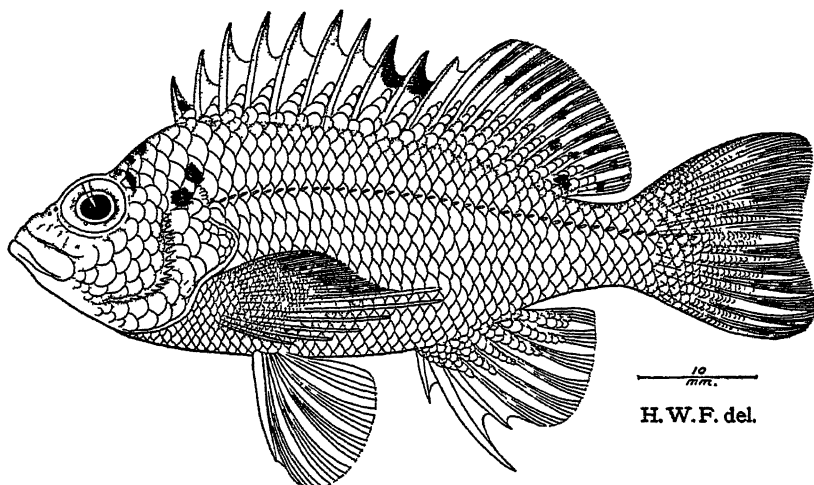


FIGURE 18.—*Cirrhitichthys analis*, new species. Type.

### Genus AMBLYCIRRHITUS Gill

#### AMBLYCIRRHITUS INDICUS, new species

*Cirrhitus fasciatus* CUVIER (not Bennett, 1828), Histoire naturelle des poissons, vol. 3, p. 76, pl. 47, 1829 (type locality, Pondicherry).—GÜNTHER, Catalogue of the fishes of the British Museum, vol. 2, p. 73, 1860 (copied).—DAY, The fishes of India, pt. 1, p. 145, 1875 (copied); suppl., p. 788, 1888.

*Amblycirrhitus fasciatus* GILL, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 105 (reference).

*Cirrhitichthys fasciatus* DAY, The fauna of British India, Fishes, vol. 2, p. 51, 1889 (Madras).

Depth  $2\frac{1}{8}$ ; head 3, width  $2\frac{2}{5}$ . Snout 3 in head; eye 4,  $1\frac{1}{2}$  in snout; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{7}{8}$ , length  $2\frac{2}{3}$  in head; teeth small, simple, conic, no canines; interorbital low, eye invading slightly front profile; hind preopercle edge serrate.

Scales 38+7 in lateral series (on Cuvier's figure); 15 transversely between soft dorsal and anal origins; 8 rows on cheek to preopercle ridge. Vertical fins scaly basally.

D. X, 12, fourth spine  $2\frac{1}{8}$  in head, first ray  $1\frac{7}{8}$ ; A. III, 6, second spine  $1\frac{1}{2}$ , third ray  $1\frac{7}{8}$ ; caudal  $1\frac{1}{3}$ , truncate; least depth of caudal peduncle  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{10}$ , rays  $\pi$ , 7, v; ventral rays I, 5, fin length  $1\frac{1}{3}$  in head.

Gray, white below. Small, scattered white spots on snout and predorsal. Four broad dark gray transverse bands on back, with narrower and paler one in each light interspace. Dorsals gray, with some small white spots. Other fins uniformly pale. (Cuvier, Day.)

*Remarks.*—India. No length is given for the species, though Cuvier's figure measures 125 mm. No material examined or seen.

Proposed to replace *Cirrhitus fasciatus* Cuvier, preoccupied by *Cirrhitus fasciatus* Bennett (Zool. Journ., vol. 4, p. 39, 1828, type locality, Sandwich Islands) = *Cirrhitus cinetus* Günther, 1860. This last therefore antedated becomes *Paracirrhitus fasciatus* (Bennett).

(Named for India.)

#### ACANTHOCIRRHITUS, new genus

*Type.*—*Cirrhitus oxycephalus* Bleeker.

Body elongately ovoid. Head small. Snout conic. Eye rather high, median in length of head. Maxillary reaches below front of eye. Mouth terminal, rather low, jaws equal or subequal. Teeth small, in bands in jaws, on vomer and palatines, mostly villiform. Interorbital narrow, low. Preopercular edge serrated. Branchiostegals 6. Scales small in lateral series. Lateral line distinct, complete, axial. Dorsal spines graduated to fourth or longest spine, which equals about  $\frac{4}{5}$  of greatest body depth. First dorsal ray longest, ends in filament, little longer than fourth dorsal spine. Anal spines long, but little shorter than fourth dorsal spine. Caudal rounded. Pectoral subequal with head. Ventral inserted well behind pectoral base.

One species, characterized by its long dorsal and anal spines. (*ἄκανθα*, spine + *Cirrhitus*.)

### Family SCORPAENIDAE

#### ANALYSIS OF GENERA

a<sup>1</sup>. Body scaly, sometimes with fleshy or skinny flaps; pectoral without free rays.

b<sup>1</sup>. Dorsal spines not greatly elongated with slender free tips; pectorals moderate.

c<sup>1</sup>. Dorsal fins continuous, undivided.

d<sup>1</sup>. Spinous dorsal begins well behind preopercle.

e<sup>1</sup>. SEBASTINAE. Dorsal spines 13 to 16; front profile more or less oblique.

Hoplosebastes

e<sup>2</sup>. SCORPAENINAE. Dorsal spines 12.

f<sup>1</sup>. Bones of head without large muciferous cavities; occiput with 2 pairs of spines; scales present, or with dermal flaps.

- g*<sup>1</sup>. Some or all pectoral rays branched.  
*h*<sup>1</sup>. Lateral line developed, complete.  
*i*<sup>1</sup>. Palatine teeth present.  
*j*<sup>1</sup>. Scales on top of head ctenoid; armature of head moderate.  
*k*<sup>1</sup>. Air bladder well developed----- *Sebastiscus*  
*k*<sup>2</sup>. Air bladder obsolete----- *Helicolenus*  
*j*<sup>2</sup>. Scales on top of head cycloid, or absent; no air bladder----- *Scorpaena*  
*i*<sup>2</sup>. No palatine teeth.  
*l*<sup>1</sup>. Head scaly, also prepectoral region----- *Scorpaenopsis*  
*l*<sup>2</sup>. Only few scales on head behind eye and on breast; prepectoral region and front of belly naked----- *Scorpaenopsella*  
*h*<sup>2</sup>. Lateral line incomplete, only on 4 or 5 scales behind suprascapula----- *Phenacoscorpius*  
*g*<sup>2</sup>. Pectoral rays all simple.  
*m*<sup>1</sup>. Lateral line without filaments.  
*n*<sup>1</sup>. No supraorbital tentacle----- *Hipposcorpaena*  
*n*<sup>2</sup>. Supraorbital tentacle half of head.  
*Nemapontinus*  
*m*<sup>2</sup>. Lateral line with row of filaments.  
*Crossoscorpaena*  
*l*<sup>2</sup>. Bones of head with large muciferous cavities; spines of head little developed; scales deciduous, cycloid.  
*Macroscorpius*  
*e*<sup>1</sup>. *PTERODICHTHYINAE*, new subfamily. Dorsal spines 11; anal spines 2----- *Pteropelor*  
*d*<sup>2</sup>. *CENTROPOGONINAE*, new subfamily. Spinous dorsal begins over vertical limb of preopercle----- *Centropogon*  
*c*<sup>2</sup>. *PLECTROGENINAE*, new subfamily. Dorsal fins divided, first with 10 spines and second with 7 rays----- *Plectrogenium*  
*b*<sup>2</sup>. *PTEROINAE*. Dorsal spines 12 or 13, greatly extended, venomous; pectoral more or less elongate; top of head with spinous crests; anal spines 3; no palatine teeth.  
*o*<sup>1</sup>. Preorbital without tentacle, or only short filament present----- *Brachypterois*  
*o*<sup>2</sup>. Preorbital with exceedingly long tentacle or barbel----- *Nemapterois*  
*a*<sup>2</sup>. Body scaleless, or if scales present rudimentary, and sometimes with dermal flaps.  
*p*<sup>1</sup>. *SCORPAENELLINAE*, new subfamily.  
Dorsal spines 12, fin undivided; pectoral moderate, large, rays all simple, united; armature of head well developed----- *Scorpaenella*  
*p*<sup>2</sup>. *MINOINAE*. Dorsal spines 10 or 11, fin undivided; pectoral moderate, lower ray detached; top of head with spinous crests----- *Minous*  
*p*<sup>2</sup>. *INIMICINAE*. Dorsal spines 15 to 18, first 3 spines separated; 2 lower pectoral rays nearly detached----- *Inimicus*

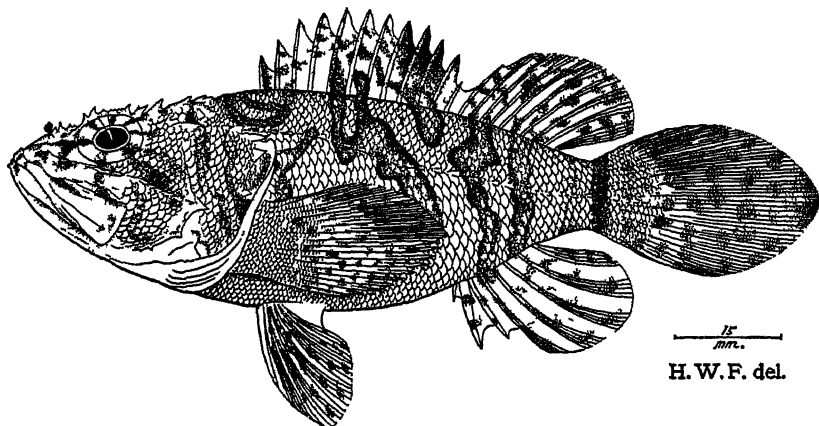
## Subfamily SEBASTINAE

## Genus HOPLOSEBASTES Schmidt

## HOPLOSEBASTES PRISTIGENTYS, new species

FIGURE 19

Depth  $2\frac{7}{8}$ ; head  $2\frac{1}{4}$ , width  $1\frac{2}{3}$ . Snout  $3\frac{4}{5}$  in head from snout tip; eye  $4\frac{1}{8}$ ,  $1\frac{1}{8}$  in snout, greatly exceeds interorbital; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{2}$  in eye, length  $1\frac{7}{8}$  in head from snout tip; teeth minutely villiform, in bands in jaws, of which upper band little wider; narrow band of fine teeth on vomer; interorbital  $6\frac{1}{2}$ , deeply concave, with deep median longitudinal channel. Gill rakers 6+11, lanceolate, 4 or 5 above and below rudimentary; length  $1\frac{3}{4}$  in gill filaments, which 3 in eye.

FIGURE 19—*Hoplosebastes pristigenys*, new species. Type.

Pair of nasal spines; 2 small anterosupraorbital spines each side, with posterior larger, then serrated edge of 5 points (entire on right supraorbital), followed by 2 postero-supraorbital spines (left double, right single), pair of coronals, pair of occipitals and finally pair of nuchals; 3 preorbital, median closer to posterior and both directed backward; suborbital stay with 8 spines (right stay with 12); 4 preopercular spines, upper largest, next below minute; 3 postoculars, first small, others large and finally large double pronged supra-scapular; 2 wide set opercular spines, opposite; strong humeral spine.

Scales 50+4 close above and along lateral line; tubular scales 26+4 in lateral line; 9 scales above, 14 below; 12 predorsal forward to occipital spines; 5 postocular scales. Head largely covered with small ctenoid scales, except muzzle and branchiostegal region. Small scales crowded on breast, prepectoral region, caudal base and belly.

Lateral line complete, axial along side of body, with rather large tubes. Scales with 5 to 7 basal radiating striae; apical denticles 24 or 25 rather strong, conic, in 2 or 3 series; circuli fine.

D. XIII, 9, 1, fifth spine  $2\frac{4}{5}$  in total head length, third ray  $2\frac{1}{8}$ ; A. III, 5, 1, second spine  $3\frac{1}{2}$ , second ray 2; caudal  $1\frac{1}{2}$ , convex behind; least depth of caudal peduncle  $4\frac{1}{5}$ ; pectoral  $1\frac{1}{2}$ , rays 1, 8, ix; ventral rays I, 5, fin  $1\frac{1}{2}$  in total head length.

Body pale brown, still little paler to whitish below. Two narrow, dark bands across interorbital. Dark band across occiput down to hind eye edge. Eye with dark brown bar forward, 3 others from its lower edge obliquely down. Narrow dark brown band from ends of occipital spines, crosses occiput and down side of head on front of opercle. Double dark brown predorsal band to middle of opercle and joined behind by broader band inclined from first 2 dorsal spines. Pair of dark brown bands down from behind fifth to sixth dorsal spines to below lateral line; another pair from ninth and tenth spines fused below and not reaching lateral line. Two dark bands down from soft dorsal well below lateral line. Pair of dark bands across caudal peduncle. All dark bands described bordered narrowly with still deeper brown. Fins light or whitish generally. Spinous dorsal with dark oblique bar from behind each spine. Fins otherwise all spotted with dark brown in contrast, as folded from dark transverse bars. Iris dark gray.

*Type*.—U.S.N.M. no. 98898. (6461.) D. 5305. Lat.  $21^{\circ}54'$  N., long.  $114^{\circ}46'$  E., China Sea, vicinity of Hong Kong. In 37 fathoms. October 24, 1908. Length 118 mm.

*Remarks*.—A handsome species, with variegated color pattern, known only from the type. It is related to *Hoplosebastes armatus* Schmidt from Nagasaki, Japan, based on a single specimen 157.5 mm long. It differs in details of coloration, the larger and more extensive spots on the fins, scaleless maxillary, the presence of 3 anal spines, and in other features.

(*πλοστis*, saw + *γένυς*, jaw.)

### Genus SEBASTISCUS Jordan and Starks

#### SEBASTISCUS TRIACANTHUS, new species

#### FIGURE 20

Depth  $2\frac{4}{5}$ ; head  $2\frac{1}{4}$ , width 2. Snout  $3\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{2}$ , equals snout, greater than interorbital; maxillary reaches  $\frac{1}{3}$  in eye, expansion  $2\frac{1}{6}$  in eye, length  $2\frac{1}{4}$  in head from snout tip; teeth finely villiform, in narrow bands in jaws and on vomer and palatines; interorbital  $6\frac{1}{5}$ , low, depressed, and with concave median channel. Gill rakers 7+15, lanceolate, equals gill filaments or 3 in eye.

Pair of small nasal spines; 1 antero-supraorbital and 2 postero-supraorbital spines; pair of small coronal spines, their points directed inward or toward one another; pair of long keels each end in small occipital spines, followed by short nuchal; 2 bifid preorbital spines, similar, on lower front edge over premaxillary; suborbital stay with 3 small, rather close set spines at middle of lower orbital rim; 5 preopercular spines, median largest and 2 lowest directed downward; 3 strong spines at supra-scapula, preceded by an elevated spine; 2 strong opercular spines, upper larger and slightly little posterior.

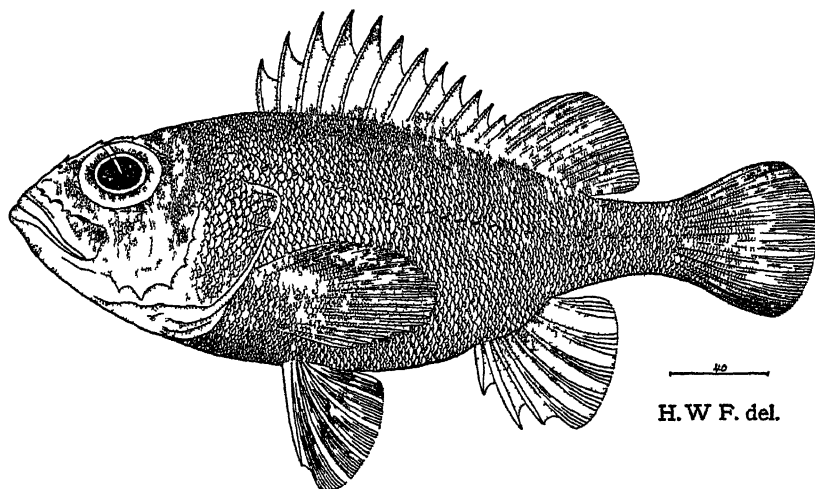


FIGURE 20—*Sebastiscus triacanthus*, new species Type

Scales 60+7 close along and above lateral line; 28+1 tubular scales in lateral line; 14 above, 18 below, 16 predorsal forward to occipital groove about opposite tips of occipital spines and very small scales still forward to upper lip. Maxillary covered with very small scales, also mandible; 14+6 scales obliquely down on cheek from lower eye edge. Fins with fine scales basally. Scales with 8 to 13 basal radiating striae; 30 to 33 slender, rather long denticles, with 2 or 3 transverse series of basal elements; circuli fine, coarser apically.

D. XII, 12, 1, fourth spine  $2\frac{2}{3}$  in total head length, third ray  $2\frac{2}{5}$ ; A. III, 6, 1, third spine  $2\frac{3}{5}$ , first ray  $2\frac{1}{8}$ ; caudal 2, little rounded behind; least depth of caudal peduncle  $4\frac{2}{5}$ ; pectoral  $1\frac{3}{5}$ , rays 1, 8, VIII; ventral rays I, 5, fin 2 in total head length.

Uniform pale or light brown, without any markings. Iris pale. Fins all uniformly light.

*Type*.—U.S.N.M. no. 44912. Japan. Japanese Government. 1893. Length 333 mm.

Differs from *Sebastiscus albofasciatus* (Lacépède) in its apparent uniformly pale coloration, the presence of 3 small spines at the lower edge of the orbit and the bifid preorbital spines.

(τρεις, three + ἀκανθα, spine.)

Genus **SCORPAENA** Linnaeus

**SCORPAENA AMPLISQUAMICEPS**, new species

FIGURE 21

Depth 3 to  $3\frac{1}{8}$ ; head  $2\frac{1}{8}$  to  $2\frac{1}{4}$ , width  $2\frac{1}{10}$  to  $2\frac{1}{5}$ . Snout  $4\frac{1}{5}$  to  $4\frac{2}{5}$  in head from snout tip; eye  $3\frac{7}{8}$  to  $4\frac{1}{8}$ , 1 in snout, greatly exceeds interorbital; maxillary reaches  $\frac{3}{5}$  to  $\frac{3}{4}$  in eye, expansion  $1\frac{4}{5}$  to 2 in eye, length  $2\frac{1}{8}$  to  $2\frac{1}{4}$  in head from snout tip; teeth in broad villiform bands in jaws, in narrower bands on vomer and palatines; interorbital  $7\frac{3}{4}$  to  $8\frac{1}{8}$ , concave; occiput with very shallow depression. Gill rakers 5+10, of which 3 or 4 above and 5 below rudimentary tubercles; gill rakers equal gill filaments or 4 in eye.

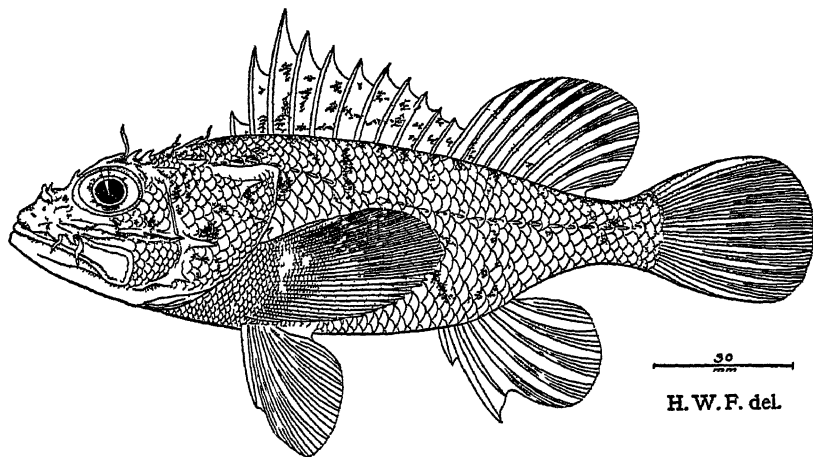


FIGURE 21—*Scorpaena amplisquamiceps*, new species. Type.

Pair of nasal spines; pair of antero-supraorbital spines and 3 pairs of postero-supraorbital spines followed by occipital and nuchal pair; very small supero-postorbital spine, followed by 2 large spines, least of which close before suprascapular spine; 2 preorbital spines, both directed backward; suborbital stay with 4 spines, first of which on preorbital bone; 4 preopercular spines, upper longest and with small prebasal spine; 2 wide set opercular spines, opposite one another; rather blunt humeral spine.

Scales 33 to 37+2 or 3 close above and along lateral line; tubular scales 22 or 23+1 in lateral line; 7 scales above, 11 below; 10 predorsal



scales forward to occiput or about opposite occipital spines, or about 18 forward until opposite hind pupil edge; 3 postoculars; scales on head all large, none on muzzle, front of interorbital, maxillary and branchiostegal region. Scales on breast, chest, prepectoral region, pectoral base and belly all much smaller than other body scales; scales on caudal base moderately small. Lateral line axial, high at first, complete; tubes simple, long, each well exposed. Scales with 15 to 18 basal radiating striae; 60 to 71 short, slender, apical denticles, with 1 or 2 transverse series of basal elements; circuli fine.

D. XII, 9, 1, third spine  $2\frac{1}{6}$  to  $2\frac{7}{8}$  in total head length, fifth ray  $2\frac{1}{6}$  to  $2\frac{2}{5}$ ; A. III, 5, 1, second spine  $2\frac{2}{5}$  to  $2\frac{2}{3}$ , second ray  $2\frac{1}{4}$  to  $2\frac{3}{5}$ ; caudal  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , hind edge convex; least depth of caudal peduncle  $4\frac{3}{4}$  to  $5\frac{1}{2}$ ; pectoral  $1\frac{3}{4}$  to  $1\frac{7}{8}$ , rays  $\pi$ , 7 or 8,  $\pi$ ; ventral rays I, 5, fin 2 in total head length.

Brown, mottled with darker and paler obscurely on back and sides. Iris grayish. Fins all pale or light, with dark basal blotch on spinous dorsal at bases of second and third membranes, and at base of sixth membrane. Few faint blotches on spinous dorsal.

*Type*.—U.S.N.M. no. 98883. (1637.) D. 5266. Matoco Point, S.  $22^{\circ}$  E., 7 miles (lat.  $13^{\circ}44'36''$  N., long.  $120^{\circ}59'15''$  E.), Verde Island Passage and Batangas Bay, Philippines. In 100 fathoms. June 8, 1908. Length 152 mm. Also a series of paratypes from Philippine seas, in 100 to 161 fathoms.

*Remarks*.—Known by its combination of characters, especially its small scales on the breast and prepectoral region, large scales on head and its large eye. Though in some respects suggestive of *Scorpaena brucephalus* Alcock, it differs in the greatly larger scales on the head. That species is shown with very small postorbital and cranial scales.

(*amphus*, large + *squama*, scale + *ceps*, head.)

SCORPAENA MEGALEPIS, new species

FIGURE 22

Depth  $2\frac{3}{4}$  to  $3\frac{3}{5}$ ; head 2 to  $2\frac{1}{8}$ , width  $1\frac{7}{8}$  to  $2\frac{1}{4}$ . Snout  $3\frac{4}{5}$  to  $4\frac{1}{4}$  in head from snout tip; eye  $3\frac{1}{3}$  to  $4\frac{1}{5}$ , greater than snout in young to subequal with age, greatly exceeds interorbital; maxillary reaches  $\frac{1}{2}$  to  $\frac{3}{5}$  in eye, expansion  $1\frac{1}{2}$  to 2, length 2 in head from snout tip; teeth villiform, in moderately wide bands in jaws and narrow band on vomer and palatines; interorbital  $8\frac{1}{2}$  to  $8\frac{3}{5}$ , concave. Gill rakers 5+12, of which 3 or 4 above and below as rudimentary tubercles; lanceolate, equal gill filaments or 3 in eye.

Pair of nasal spines; pair of antero-supraorbital spines and 3 pairs of postero-supraorbital spines, followed by a pair of occipitals and a pair of nuchals; occipital depression slight; 3 postocular spines, first small and finally small suprascapular spine; small and incon-

spicuous tympanic spine close over third postocular spine; 2 preorbital spines, posterior larger and directed little backward; suborbital stay with 4 spines, of which first on preorbital bone; 4 preopercular spines, upper largest, with small spine on outer basal part; 2 widely divergent opercular spines, lower little posterior; humerus with broad rounded keel, without spine.

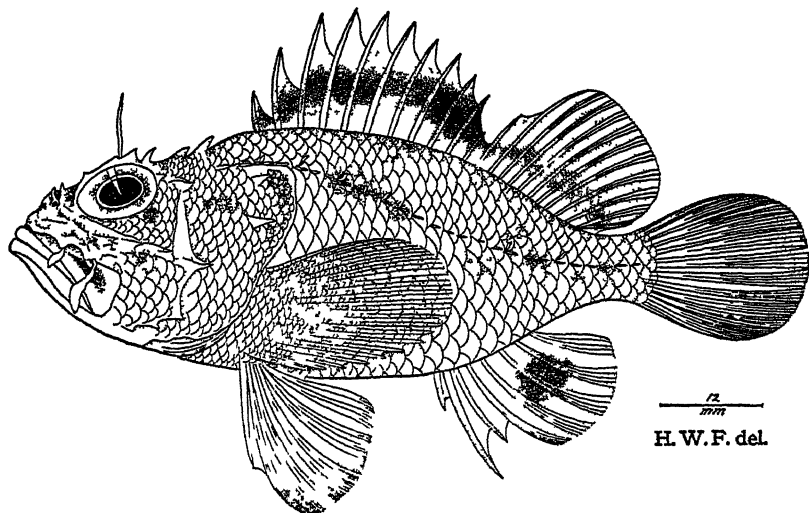


FIGURE 22.—*Scorpaena megalepis*, new species Type

Scales 25 to 28+2 close along and above lateral line; tubular scales 22 or 23+1 or 2 in lateral line; 4 scales above, 9 below; 10 predorsal forward opposite hind pupil edge; 3 postoculars. Scales on postocular, cheek and opercle, little smaller on occiput, rest of head naked. Moderate scales on breast, chest, prepectoral region, and caudal base, though much smaller than lateral scales of body; small scales on pectoral base. Lateral line high at first, axial, complete. Scales with 7 or 8 basal radiating striae; 55 to 58 apical denticles, with 3 or 4 transverse series of basal elements; circuli fine. Nostril with filament; first postero-supraorbital spine with filament nearly long as eye; filament at occipital spine, long, fringed flap and posterior preorbital spine, and another at upper preopercular spine.

D. XII, 9, 1 or 10, 1, third spine  $2\frac{1}{2}$  to  $2\frac{2}{3}$  in total head length, fourth ray  $2\frac{1}{4}$  to  $2\frac{2}{3}$ ; A. III, 5, 1, second spine  $2\frac{1}{4}$  to  $2\frac{2}{3}$ , first ray  $2\frac{1}{4}$  to  $2\frac{1}{3}$ ; caudal  $1\frac{1}{6}$ , convexly rounded behind; least depth of caudal peduncle  $4\frac{1}{6}$  to 5; pectoral  $1\frac{3}{5}$  to  $1\frac{2}{3}$ , rays 1, 9, x; ventral I, 5, fin  $1\frac{1}{5}$  to 2 in total head.

Body brownish, mottled or variegated obscurely with darker on back and sides. Under portions paler to whitish. Fins pale generally. Spinous dorsal with median row of dark blotches, obscurely

defined at eighth to tenth spines, membranes entirely blackish over greater terminal portions. Soft dorsal with subbasal dark or brownish band. Anal with grayish transverse band medially. Pectoral with few indistinct grayish spots on each of upper rays.

*Type*.—U.S.N.M. no. 98897. (6462.) D. 5305. Lat.  $21^{\circ}54'$  N., long.  $114^{\circ}46'$  E., China Sea, vicinity of Hong Kong. In 37 fathoms. October 24, 1908. Length 98 mm.

Also several paratypes from the China Sea and the Philippines in 34 to 45 fathoms.

*Remarks*.—An interesting small species, known by its coloration and characters in combination. Its profile is less steep than in *Scorpaena* and its eye smaller in specimens of similar size. Characteristic are the dark bands on the dorsals and anals.

(μέγας, great+λεπτός, scale.)

SCORPAENA GIBBIFRONS, new species

FIGURE 23

Depth  $2\frac{3}{5}$ ; head 2, width  $1\frac{1}{4}$ . Snout  $4\frac{2}{5}$  in head from snout tip; eye  $3\frac{3}{5}$ , greater than snout, or interorbital; maxillary reaches  $\frac{4}{5}$  in eye, expansion  $1\frac{2}{3}$  in eye, length 2 in head from snout tip; teeth finely villiform, in moderate wide bands in jaws, and narrow band on vomer and each palatine; interorbital 7, deeply concave, with deep median channel. Gill rakers 6+12, of which 3 or 4 rudimentary above and below; clavate, 3 in eye; gill filaments  $\frac{3}{4}$  of gill rakers.

Pair of small nasal spines; pair of small antero-supraorbital and 3 pairs of posterosupraorbital spines, followed by pair of occipitals and nuchals, of which latter much longest; 2 small spines on upper hind orbital edge, followed by 2 large postocular spines and a suprascapular; 2 preorbitals posterior larger and directed down and back; suborbital stay with 3 spines; preopercular spines 5, uppermost longest and with small prebasal spine; then third spine below equally long though intermediate or second spine small; 2 wide set opercular spines, upper much larger, about opposite; broad, strong spine on humerus.

Scales 28+2 along and close above course of lateral line; tubular scales 21+1? in lateral line; 5 scales above, 8 below; 7 predorsal forward to occiput; 3 postocular. Head scaled on postocular, cheek and opercle, otherwise naked. Scales on chest and breast rather large, small on pectoral and caudal bases. Lateral line complete, high at first, axial; tubes large, simple and well exposed. No fleshy flap in pectoral axil. Scales with 11 to 14 basal radiating striae; 50 to 62

small, slender, apical denticles, with 1 or 2 series of basal elements transversely; circuli fine, coarser or obsolete apically.

D. XII, 9, 1, third spine 2 in total head length, second branched ray  $2\frac{1}{5}$ ; A. III, 5, 1, second spine  $2\frac{1}{3}$ , first branched ray  $2\frac{1}{2}$ ; caudal  $1\frac{5}{8}$ , evidently rounded (damaged) behind; least depth of caudal peduncle  $4\frac{7}{8}$ ; pectoral  $1\frac{3}{8}$ , rays  $\pi$ , 4,  $\chi$ 1; ventral I, 5, fin  $1\frac{2}{10}$  in total head length.

Pale brown generally, blotched or clouded obscurely with paler and lighter. Iris very light brown. Fins all pale, with obscure whitish and pale brown bars or spots. Ventral whitish.

*Type*.—U.S.N.M. no. 98900. (4277.) D. 5482. Cabugan Grande Island (N.), N.  $87^{\circ}$  W., 4.5 miles (lat.  $10^{\circ}27'30''$  N., long.  $125^{\circ}18'$  E.), between Samar and Leyte, vicinity of Surigao Strait. In 67 fathoms. July 30, 1909. Length 89 mm.

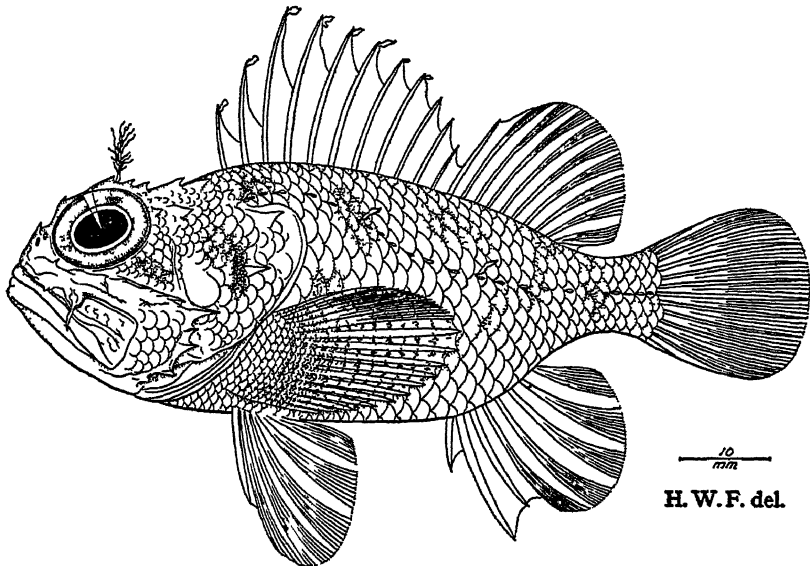


FIGURE 23 —*Scorpaena gibbifrons*, new species. Type.

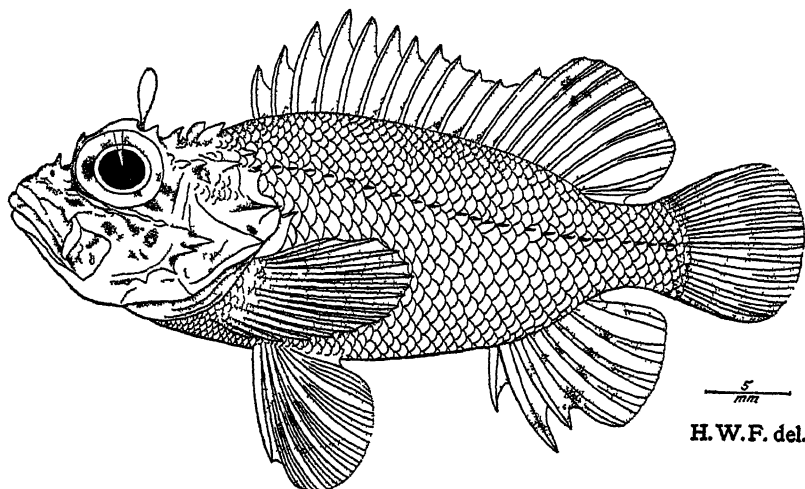
*Remarks*.—Only the type known. Somewhat resembles *Sebastes coloratus* Gilbert, here regarded as a *Scorpaena*, but differing in its scaly head, no blackish blotch on spinous dorsal and much larger scales. Also the scales on the postocular smaller than elsewhere on the head in *Scorpaena megalepis*. *Scorpaena bucephalus* Alcock agrees with my species in this respect, as well as in other characters, but it has a different physiognomy with a more extended and less abrupt muzzle, shorter pectoral, and it is figured with much smaller scales.

(*gibbifrons*, short front, or short snout.)

## SCORPAENA MCADAMSI, new species

FIGURE 24

Depth  $2\frac{1}{2}$  to  $2\frac{4}{5}$ ; head  $2\frac{1}{10}$  to  $2\frac{1}{8}$ , width  $1\frac{1}{2}$  to  $1\frac{2}{3}$ . Snout  $3\frac{1}{2}$  to 4 in head from snout tip; eye  $3\frac{3}{5}$  to 4, subequal with snout, greater than interorbital; maxillary reaches  $\frac{1}{2}$  to  $\frac{3}{5}$  in eye, expansion  $1\frac{2}{5}$  to  $1\frac{3}{5}$ , length  $1\frac{4}{5}$  to  $1\frac{7}{8}$  in head from snout tip; teeth in narrow, villiform bands in jaws, on vomer and palatines; interorbital 5 to  $5\frac{3}{4}$ , deeply concave; occipital depression moderate, transverse, close behind level of eyes. Gill rakers 5+8, short tubercles  $\frac{1}{2}$  of gill filaments, which  $2\frac{3}{4}$  in eye.

FIGURE 24.—*Scorpaena mcadamsi*, new species. Type.

Nasal pair of spines moderate; short antero-supraorbital spine forward, and 2 postero-supraorbitals each side, close, well back; pair of strong nuchal spines, close behind posterior of 2 postero-supraorbitals; parietal and occipital pair of spines each strong; posterior preorbital spine small, directed down; suborbital stay with 2 short spines; 4 preopercular spines, with small auxiliary at uppermost basally; strong postocular; suprascapular spine present; 2 opercular spines; humeral spine well developed.

Scales 27+3 close above and along lateral line; tubular scales 21+ in lateral line; 6 scales above, 12 below; 5 predorsal. Opercle and postocular region scaly above. Usually fringed supraocular flap, at least long as eye. Scales with 7 or 8 short, marginal, subparallel basal striae; circuli 18 to 20, moderate.

D. XII, 10, fourth spine  $2\frac{2}{5}$  to  $2\frac{1}{2}$  in total head length, second ray 2 to 3; A. III, 5, second spine 2 to  $2\frac{1}{4}$ , second ray  $1\frac{4}{5}$  to  $1\frac{7}{8}$ ; caudal

$1\frac{1}{2}$  to  $1\frac{3}{5}$ , convex behind; least depth of caudal peduncle  $3\frac{1}{2}$  to  $4\frac{1}{5}$ ; pectoral from origin  $1\frac{1}{2}$  to  $1\frac{3}{5}$ , rays 15; ventral rays I, 5, fin  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in total head length.

Largely uniform brown, fins little paler. Iris gray. From ninth to eleventh dorsal spines marginally and submarginally with blackish blotch. Caudal with slight longitudinal dark band on middle of each half of fin longitudinally.

*Type*.—U.S.N.M. no. 98904. (1816.) D. 5174. Jolo Light, E. 2.6 miles (lat.  $6^{\circ}3'45''$  N., long.  $120^{\circ}57'$  E.), in vicinity of Jolo. In 20 fathoms. March 5, 1908. Length 49 mm.

*Series of paratypes*.—D. 5254. Linao Point, N.  $44^{\circ}$  E., 0.7 mile (lat.  $7^{\circ}5'42''$  N., long.  $125^{\circ}39'42''$  E.), Gulf of Davao. In 21 fathoms. May 18, 1908. Length 35 to 45 mm.

*Remarks*.—Distinguished by its combination of characters, especially the simple pectoral rays, the second preorbital spine directed down and its supraocular flap, dark blotch on spinous dorsal and usually uniform coloration. In these respects it differs from *Scorpaena bandanensis* Bleeker.

(Named for Fred McAdams, of Cape May, N. J., to whom I am indebted for many interesting off-shore American fishes.)

SCORPAENA PALLIDIMACULA, new species

FIGURE 25

Depth 3; head 2, width  $2\frac{1}{5}$ . Snout  $4\frac{1}{4}$  in head from snout tip, over twice eye diameter; orbit  $3\frac{2}{3}$  in head from snout tip; maxillary reaches  $\frac{2}{3}$  in orbit, expansion  $1\frac{3}{4}$  in eye, length 2 in head from snout tip; mandible with moderate, bony, symphyseal spur; teeth finely villiform, in moderately broad bands in jaws, and narrow bands on vomer and palatines; interorbital 10, deeply concave, with 2 distinct longitudinal keels; slight depression on cranium. Gill rakers 7+12, of which 3 or 4 above and below rudimentary tubercles; length  $1\frac{1}{2}$  in gill filaments, which  $3\frac{1}{2}$  in adult.

Pair of small nasal spines; pair of antero-supraorbital spines and 3 pairs of postero-supraorbital spines, followed by pair of occipitals and larger pair of nuchals; small spine at upper hind edge of orbit, followed by 2 long spines and then 1 at suprascapula; 2 preorbital spines, posterior larger and directed little down and backward; sub-orbital stay with 3 spines; 3 preopercular spines, uppermost longest and with small prebasal spine; 2 wide set opercular spines, lower little posterior; very blunt, short, humeral spine.

Scales 40+3 close along and above lateral line; tubes 24+1? in lateral line; 5 scales above, 12 below; 17 predorsal forward to hind

eye edge; 3 or 4 postocular scales. Head with ctenoid scales, large on cheek, postocular region, opercle and top of head, rest naked. Scales moderately small on chest, breast, prepectoral region and caudal base. Lateral line high at first, axial along side of body, complete; tubes large, simple, single, well exposed. Scales with 6 to 11 basal radiating striae; 19 to 30 short slender apical denticles; circuli fine basally, coarser to obsolete terminally. Small cutaneous filaments at nostril, antero-supraorbital spine, first of postero-supra-orbital spines and upper opercular spine.

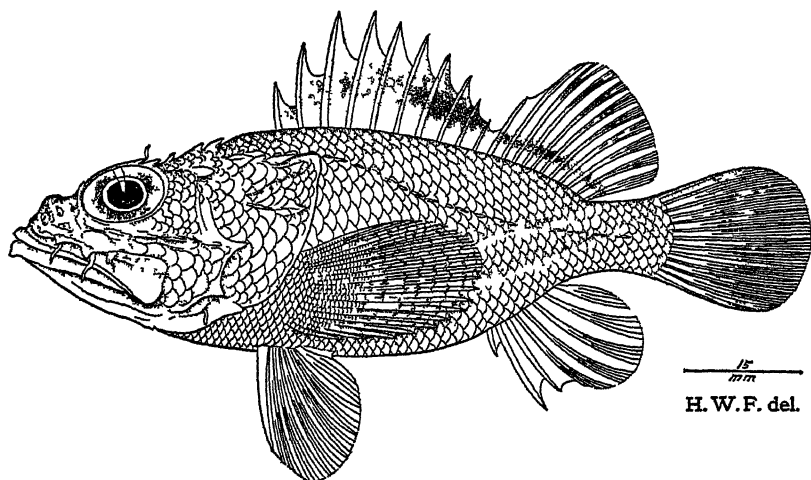


FIGURE 25.—*Scoipaena pallidimacula*, new species Type.

D. XII, 10, 1, fourth spine  $2\frac{3}{4}$  in total head length, third ray 3; A. III, 5, 1, second spine  $2\frac{3}{5}$ , first ray  $2\frac{7}{8}$ ; caudal 2, little convex behind; least depth of caudal peduncle 5; pectoral  $1\frac{7}{8}$ , rays 1, 9, x; ventral I, 5, length 2 in head.

Pale brownish, with some slightly darker cloudings on back and sides, under surfaces paler. Iris pale gray. Fins pale. Dark brown blotch on seventh to ninth membranes of spinous dorsal. Soft dorsal with some obscure brown shades on membranes.

*Type*.—U.S.N.M. no. 98889. (2557.) D. 5241. Uanivan Island (N.), S.  $68^{\circ}$  E., 3 miles (lat.  $6^{\circ}50'45''$  N., long.  $126^{\circ}14'38''$  E.), Pujada Bay and vicinity. In 215 fathoms. May 14, 1908. Length 98 mm.

*Remarks*.—Known by its large eye, dark blotch on the spinous dorsal, and general physiognomy.

(*pallidus*, pale + *macula*, spot; with reference to the inconspicuous blotch on the spinous dorsal.)

## OSORIOIA, new subgenus

*Type*.—*Scorpaena hemilepidota*, new species.

Body elongately ovoid, well compressed, back little elevated. Head large, compressed. Snout broad, rather obtuse. Eye moderate, reaches upper profile and nearly before middle in head length. Maxillary reaches below eye, well expanded behind. Mouth large, lower jaw slightly protruded. Bands of teeth in jaws, and on vomer and palatines. Interorbital deeply concave, with median channel. Slight quadrate depression at occiput. Gill opening large, membranes only slightly united in front. Gill rakers few, rather thick and blunt. Armature of head strong. Scales rather large, ctenoid. Head, breast, chest, prepectoral region and front of belly naked. Lateral line complete, high at first, axial along side of body; tubes distinct. Few rather short skinny flaps on head. Dorsal continuous, soft fin smaller and little higher than spinous. Anal small, second spine longest, though third but little shorter and first slightly more than second. Pectoral with broad base, fin rather short. Ventral inserted opposite pectoral origin, fin large.

Differs from subgenus *Scorpaena* in its naked head, shoulder girdle, breast, and front of belly.

(Named for Dr. Balthazar Osorio, in commemoration of his many important contributions to African ichthyology.)

## SCORPAENA HEMILEPIDOTA, new species

## FIGURE 26

Depth  $2\frac{7}{8}$ ; head  $2\frac{1}{8}$ , width 2. Snout  $3\frac{4}{5}$  in head from snout tip; eye 6,  $1\frac{3}{5}$  in snout, 1 in interorbital; orbit  $4\frac{2}{5}$  in head from snout tip,  $1\frac{1}{4}$  in snout, little greater than interorbital; maxillary reaches  $\frac{2}{3}$  in eye, expansion  $1\frac{2}{5}$  in eye, length 2 in head from snout tip; teeth in villiform bands in jaws, where widest, and narrow on vomer and palatines; interorbital  $6\frac{3}{4}$  in head from snout tip. Gill rakers 6+13, of which 5 are above and below rudimentary tubercles; others robust and obtuse compressed rods,  $1\frac{1}{4}$  in gill filaments, which  $1\frac{4}{5}$  in eye.

Pair of nuchal spines; pair of antero-supraorbital and 2 pairs of postero-supraorbital spines, with little closer pair of coronals posteriorly, followed by pair of occipital and nuchal spines; cluster of 3 short, small, supero-postocular spines and finally large suprascapular spine; tympanic spine above last postocular smaller; 2 preorbital spines, posterior larger and directed downward; suborbital stay with 3 spines; 5 preopercular spines, upper largest and with small prebasal spine; pair of divergent opercular spines, opposite one another; strong humeral spine pointing obliquely up and back.



Scales 32+3 close along and above on lateral line; tubular scales 23+1 in lateral line; 5 scales above, 14 below; 6 predorsal forward to occiput. Head, breast, chest, prepectoral and front of belly naked. Small scales on posterior part of abdomen. Lateral line complete,

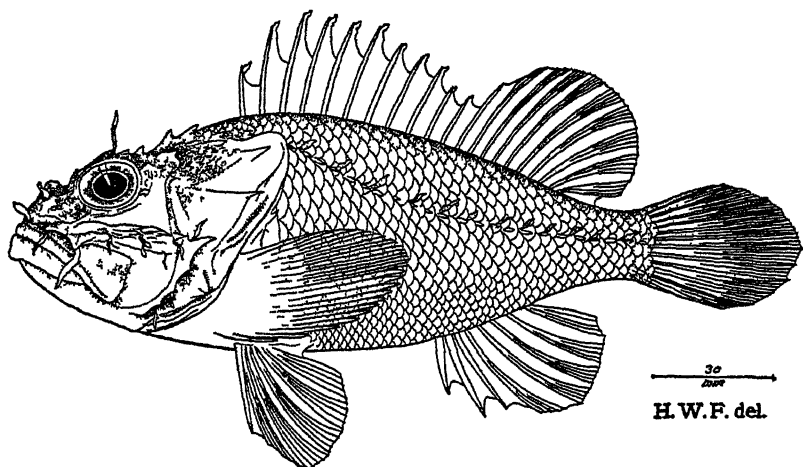


FIGURE 26.—*Scorpaena hemalepoidota*, new species Type.

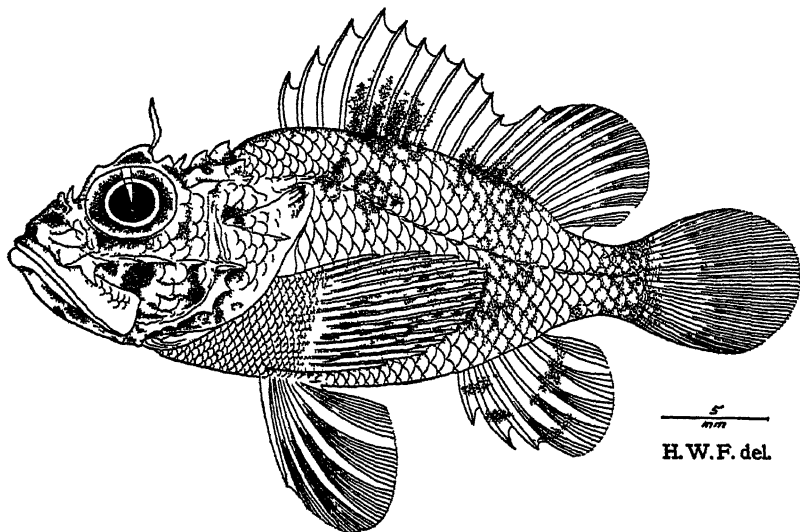


FIGURE 27.—*Scorpaenopsis cottioeps*, new species Type

continuous, axial along side of body; tubes long, simple, well exposed. Scales with 10 to 14 basal radiating striae; 31 to 33 slender, uniform, apical denticles; circuli very fine. Nostril, each supra-orbital spine, occipital spines, preorbital spines and those of sub-

orbital stay, preopercular spines, humeral spine, and lateral line with skinny flaps or filaments.

D. XI, 1, 9, third spine  $2\frac{2}{3}$  in total head length, fourth ray  $2\frac{1}{8}$ ; A. III, 5, 1, second spine  $3\frac{1}{4}$ , second ray  $2\frac{1}{2}$ ; caudal  $1\frac{3}{8}$ , convex behind; least depth of caudal peduncle  $4\frac{2}{3}$ ; pectoral  $1\frac{4}{5}$ , rays 1, 7, XI; ventral I, 5, fin 2 in total head length.

Light brownish generally, body clouded or shaded more brownish above, under surfaces paler to whitish. Iris gray-brown. Fins all pale brown.

*Type*.—U.S.N.M. no. 98884. (3521.) D. 5392. Tubig Point, N.  $49^{\circ}$  E., 5 miles (lat.  $12^{\circ}12'35''$  N., long.  $124^{\circ}2'48''$  E.), between Samar and Masbate. In 135 fathoms. March 13, 1909. Length 202 mm.

(ἡμί, half + λεπίδωτος, scaled.)

### Genus SCORPAENOPSIS Heckel

#### SCORPAENOPSIS COTTICEPS, new species

#### FIGURE 27

Depth  $2\frac{2}{3}$ ; head 2, width 2. Snout 3 in head from snout tip; eye  $3\frac{7}{8}$  in head from snout tip,  $1\frac{1}{10}$  in snout, greater than interorbital; maxillary reaches  $\frac{3}{4}$  in eye, expansion  $1\frac{1}{3}$ , length  $1\frac{9}{10}$  in head from snout tip; teeth fine, villiform, minute, in bands in jaws and on vomer, none on palatines; interorbital  $5\frac{2}{3}$ , deeply convex; deep bean-shaped pit or depression on occiput. Gill rakers 4+10, low tubercles,  $\frac{1}{2}$  of gill filaments, which 2 in eye.

Pair of slender nuchal spines; pair of small antero-supraorbital spines, and 2 pairs of broad postero-supraorbital spines, pair of small tympanics, pair of broad parietals, and pair of broad occipitals; 2 postoculars each side, hind one larger; temporal spine moderate; suprascapular spine low; 2 widely diverging preorbital spines each side, front one directed forward and posterior directed backward; suborbital stay with 4 low spines; 4 preopercular spines, upper longest and with basal auxiliary; 2 divergent opercular spines; humeral spine well developed.

Scales 26+3 along, and close above, in lateral line; pores 20+ in lateral line; 5 scales above, 11 below, 6 predorsal. Opercle with few small scales. Small scales on breast, chest, and prepectoral region. Scales with 6 or 7 basal radiating striae; 10+10 uniform low, weak, apical denticles; circuli fine.

D. XII, 10, fourth spine  $2\frac{3}{4}$  in total head length, first ray  $2\frac{3}{4}$ ; A. III, 5, second spine 3, second ray  $2\frac{1}{4}$ ; caudal  $1\frac{1}{2}$ , convex behind; least depth of caudal peduncle  $5\frac{1}{3}$ ; pectoral  $1\frac{2}{5}$ , rays 14, all simple; ventral rays I, 5, fin  $1\frac{4}{5}$  in total head.

Light brown, mottled with brown. Fins all pale. Iris brassy. White spots on lower sides of head and mandible. Pectoral rays with small brown spots.

*Type*.—U.S.N.M. no. 98891. D. 5159. Tinakta Island (N.), N. 82° W., 1.40 miles (lat. 5°11'50" N., long. 119°54' E.), Sulu Archipelago, Tawi Tawi Group. In 10 fathoms. February 21, 1908. Length 38 mm.

(*Cottus*, sculpin + κεφαλή, head.)

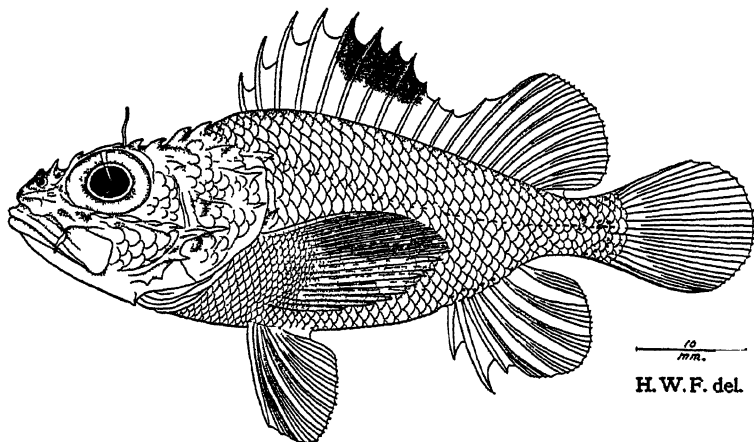


FIGURE 28.—*Scorpaenopsis stigma*, new species Type.

**SCORPAENOPSIS STIGMA, new species**

FIGURE 28

Depth  $2\frac{7}{8}$ ; head  $2\frac{1}{4}$ , width  $1\frac{1}{2}$ . Snout 4 in head from snout tip; eye 3, greater than snout, much greater than interorbital; maxillary reaches opposite  $\frac{3}{5}$  in eye, expansion  $1\frac{3}{4}$  in eye, length  $1\frac{5}{8}$  in head from snout tip; minute, villiform teeth in bands in jaws and small band on vomer, none on palatines; interorbital 9 in head, deeply concave. Gill rakers 6+14, lanceolate; gill filaments  $\frac{3}{4}$  of gill rakers, which  $3\frac{1}{2}$  in eye.

Pair of strong nasal spines behind front pair of nostrils; low antero-supraorbital spine and 2 greatly higher, strong postero-supraorbital spines each side, followed by coronal pair, then large parietal pair and finally occipital pair; strong postocular spine over top of preopercle, followed by another over top of opercle and one at suprascapula; 2 broadly obtuse preorbital spines; suborbital stay with 5 strong spines, followed by strong spine at preopercle angle, last with outer prebasal spine; lower preopercle edge with 3 spines of which upper directed back and 2 lower directed downwards; 2

wide set opercular spines, lower little posterior; strong, oblique humeral spine.

Scales 26+2 in lateral line; 4 above, 9 below, 13 predorsal forward to middle of eye, of which 5 extend forward to occiput; 2 postocular to preopercle ridge. Scales small on chest, breast, belly, prepectoral region and caudal base. Cirri at antero-supraorbital spine, first postero-supraorbital, behind each parietal, posterior preorbital and second preopercular. Lateral line little high at first, axial, tubes small, simple, and inconspicuous. Scales with 6 or 7 basal radiating striae; 7 or 8 close set short apical denticles; circuli fine, concentric, many rings extended apically.

D. XII, 9, 1, third spine  $2\frac{2}{3}$  in total head length, third ray  $2\frac{3}{4}$ ?; A. III, 5, second spine  $2\frac{1}{3}$ , third ray 2; caudal  $1\frac{4}{7}$ , rounded behind; least depth of caudal peduncle 5; pectoral  $1\frac{1}{2}$ , rays I, 6, VIII; ventral rays I, 5, fin 2 in total head length.

Body brown, head and fins paler to whitish. Iris gray. Black blotch large as eye on membrane of spinous dorsal from fifth to tenth spines.

*Type*.—U.S.N.M. no. 98896. D. 5518. Point Tagolo Light, S.  $64^{\circ}$  W., 8.7 miles (lat.  $8^{\circ}48'$  N., long.  $123^{\circ}31'$  E.), northern Mindanao and vicinity. In 200 fathoms. August 9, 1909. Length 69 mm.

Also paratype. Same data. Length 68 mm.

*Remarks*.—Characterized by its heavy armature of the head with cirri, absence of palatine teeth, lowest 8 pectoral rays simple, short gill rakers and the large conspicuous black blotch on the spinous dorsal.

(στυμα, spot, with reference to the spinous dorsal.)

#### SCORPAENOPSELLA, new genus

*Type*.—*Scorpaenopsella armata*, new species.

Body elongately ellipsoid or greatest depth midway in the standard length, well compressed. Head large, nearly half of standard length, well compressed. Snout rather obtusely conic. Eye large, impinging on upper profile, well advanced in head. Mouth large, superiorly terminal, or with lower jaw protruded and furnished with low, blunt or rounded symphyseal knob. Maxillary reaches below eye, expanded behind. Teeth small, pointed, in 4 or 5 irregular rows above; fewer rows below and with outer enlarged row, which alone extends posteriorly in jaws. Interorbital deeply concave. Gill opening very large, membrane forming narrow fold across isthmus. Head with but few scales behind eye and on opercle. Scales on body rather small. Lateral line complete, conspicuous. No scales on chest, prepectoral or front of belly. Spinous dorsal

lower than soft dorsal, fins not deeply notched. Anal small, second spine longest, third subequally shorter, first less than half of second. Caudal moderate. Pectoral rather short, with broad deep base. Ventral inserted before pectoral origin.

Small fishes like *Scorpaenopsis* but only with scales on the head behind eyes and on breast, the prepectoral region and front of the belly naked. The armature of the head strong.

(*Scorpaena*+*ψ*, appearance+*ella*, diminutive.)

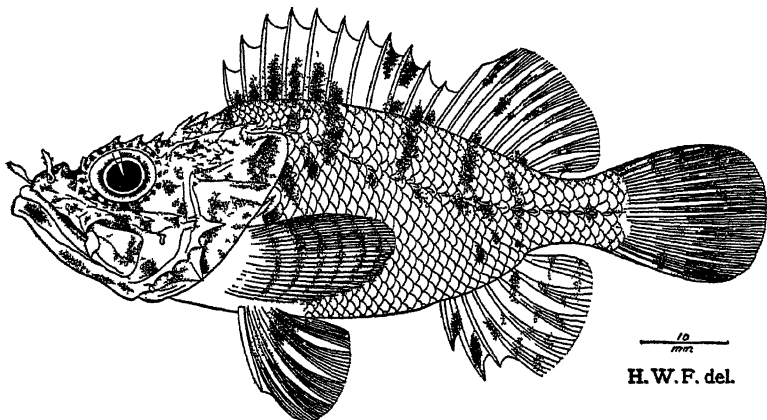


FIGURE 29—*Scorpaenopsella armata*, new genus, new species Type.

**SCORPAENOPSELLA ARMATA, new species**

FIGURE 29

Depth  $2\frac{3}{4}$ ; head  $2\frac{1}{8}$ , width  $1\frac{7}{8}$ . Snout  $\frac{3}{8}$  in head from snout tip; eye  $4\frac{1}{2}$ ,  $1\frac{1}{4}$  in snout, greatly exceeds interorbital; orbit  $\frac{3}{8}$  in head from snout tip, equals snout; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{3}$  in eye, length 2 in head from snout tip; teeth small, pointed, moderately broad band above, lower band narrower with outer row little enlarged and along whole extent of mandible; triangular band of small teeth on vomer, none on palatines; interorbital 7, deeply concave, with deep, median, longitudinal channel; rather deep quadrate occipital depression. Gill rakers 6+12, of which 4 or 5 above and below short asperous tubercles; gill rakers subequal with gill filaments, which 3 in eye.

Pair of short, strong nasal spines; antero-supraorbital spines low and 3 pairs of postero-supraorbital spines, followed by occipital and nuchal pair; 2 small suprapostocular spines, followed by 2 large ones and finally suprascapular spine; small tympanic spine over and close to second (fourth of entire series) large postocular; blunt anterior preorbital spine directed downward; suborbital stay with 3 spines; 5

preopercular spines, upper largest, with small spine before its base externally; 2 wide set opercular spines, opposite, lower nearly reaching gill opening; strong humeral spine inclined back and upward.

Scales  $37+3?$  close above and along lateral line; tubular scales  $23+1?$  in lateral line; 6 scales above, 14 below; 3 postocular; 9 predorsal to occipital spines. Head largely naked, except patch of few postocular scales and small area on upper part of opercles. Chest, breast, prepectoral region, front of abdomen and pectoral bases naked. Lateral line high, slopes along side of body axially; tubes large, simple, well exposed. Scales with 8 or 9 basal radiating striae; apical denticles 17 to 20, slender, rather long, uniform; circuli fine. Flap long as pupil each side of snout tip; large fringed flap from front nostril; small filament from first postero-supraorbital spine; large flap from second preorbital spine.

D. XII, 9, 1, third spine  $3\frac{1}{10}$  in total head length, third ray  $2\frac{3}{5}$ ; A. III, 5, 1, second spine  $3\frac{1}{4}$ , first ray  $2\frac{1}{2}$ ; caudal  $1\frac{2}{3}$ , convex behind; least depth of caudal peduncle 5; pectoral  $1\frac{9}{10}$ , rays II, 7, XI; ventral rays I, 5, fin 2 in total head length.

Light brown, paler to whitish below. Obscure darker brown bar across predorsal and 5 others from bases of dorsals on back, first at fifth dorsal spine, second at seventh, third at eleventh, fourth at third dorsal ray, fifth at seventh. Dark bar from lower eye edge down on cheek. Spinous dorsal with dark brown terminally on membranes as well as basally. Soft dorsal with obscure brown blotches. Several gray spots on pale or whitish anal. Caudal whitish, with 3 or 4 very indistinct darker transverse bars. Pectoral brown, with 4 dark bars transversely, outer 2 wider. Ventral whitish, little brownish terminally.

*Type*.—U.S.N.M. no. 98893. (2098.) D. 5117. Sombrero Island, S.  $17^{\circ}$  E., 10.8 miles (lat.  $13^{\circ}52'22''$  N., long.  $120^{\circ}46'22''$  E.), Balayan Bay and Verde Island Passage. In 118 fathoms. January 21, 1908. Length 88 mm.

(*amata*, armed, with reference to the spines on the head.)

#### PHENACOSCORPIUS, new genus

*Type*.—*Phenacoscorpius megalops*, new species.

Body compressed, elongately ovoid, back but little elevated. Head large, compressed. Snout short, obtuse, less than eye. Eye large, nearly in front half of head, meets upper profile. Mouth large, closed jaws nearly even. Maxillary reaches below eye, expanded behind. Teeth in villiform bands in jaws, on vomer, none on palatines. Interorbital narrow, concave. Gill opening wide, membranes scarcely united, free from isthmus. Gill rakers lanceolate. Pseudobranchiae well developed. Spines of head strongly developed,

large, conspicuous, with high keels and sharp points. Few slender filaments on head. Scales large, weakly ctenoid, cover most of head, but fins except caudal base naked. Lateral line very short, only slightly developed on several anterior scales. Dorsals moderately notched, spines moderate and soft fin shorter than spinous. Anal like soft dorsal, spines slender, second largest. Caudal rounded. Pectoral moderate, reaches anal. Ventral small, inserted slightly before pectoral.

Characterized chiefly by its imperfect lateral line, large scales, heavy armature of the head and large eyes.

(φένοξ, cheat + *Scorpius*, with reference to the incomplete lateral line.)

PHENACOSCORPIUS MEGALOPS, new species

FIGURE 30

Depth  $2\frac{4}{5}$  to 3; head  $2\frac{1}{5}$  to  $2\frac{1}{3}$ , width  $1\frac{3}{4}$  to  $1\frac{7}{8}$ . Snout 4 to  $4\frac{1}{5}$  in head from snout tip; eye  $3\frac{1}{2}$  to  $3\frac{3}{5}$ , greater than snout or interorbital; orbit  $3\frac{1}{8}$  to  $3\frac{2}{5}$  in head from snout tip; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{2}$  to  $1\frac{7}{8}$  in eye, length 2 in head from snout tip; teeth finely villiform, in bands of moderate width in jaws, and small triangular band on vomer, none on palatines; interorbital  $8\frac{1}{2}$  to  $9\frac{1}{8}$ , deeply concave. Gill rakers 7+14, lanceolate, of which 4 or 5 above and below rudiments; slightly longer than gill filaments or 3 in orbit.

Spines all well developed, strong; pair of nasals; pair of antero-supraorbitals, 3 pairs of postero-supraorbitals followed by 2 strong occipital and nuchal pairs; 3 postoculars, first small and close behind eye; strong suprascapular spine; 2 very broad obtuse preorbitals; suborbital stay with 6 or 7 spines, of which last may be double; 4 preopercular spines, with small one at outer front edge of uppermost, which longest; 2 widely divergent opercular spines, opposite and lower sometimes extends over gill opening; strong oblique humeral spine.

Scales 30+3 close above and along axial row of scales on side; 14 or 15 scales transversely at origins of soft dorsal and spinous anal; 3 postocular scales; 17 predorsal forward to middle of eyes. Lateral line very incomplete, only extends from suprascapula back over 4 or 5 scales, tubes large, well exposed and simple. Scales with 8 to 12 basal radiating striae; row of 14 to 18 rather long, weak apical denticles; circuli fine, coarser apically. Scales much smaller on breast, chest, and belly than on sides. More or less slender, simple, filaments at second supraorbital, occipital and second preorbital spines.

D. XII, 9, 1, fourth spine  $2\frac{7}{8}$  to 3 in head, fourth ray  $2\frac{1}{6}$  to  $2\frac{1}{3}$ ; A. III, 5, 1, second spine  $2\frac{3}{5}$  to  $2\frac{2}{3}$ , third ray  $2\frac{1}{8}$  to  $2\frac{1}{5}$ ; caudal  $1\frac{4}{5}$  to  $1\frac{7}{8}$ , rounded convexly behind; least depth of caudal peduncle  $4\frac{1}{5}$  to  $4\frac{4}{5}$ ; pectoral  $1\frac{1}{3}$  to  $1\frac{2}{3}$ , rays 1. 8, VIII; ventral rays I, 5, fin  $1\frac{7}{8}$  to 2 in total head length.

Pale brownish generally. Iris grayish above. Fins all pale to whitish. Spinous dorsal with dark brown to blackish blotch on sixth or seventh (or even eighth) membranes.

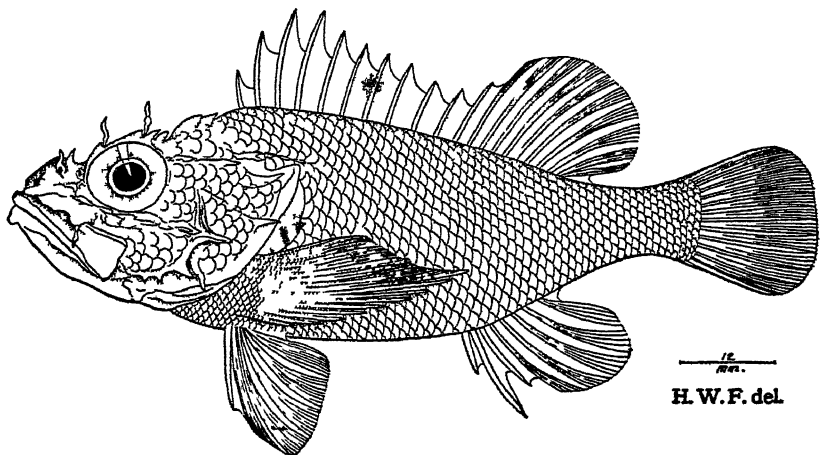


FIGURE 30—*Phenacoscorpis megalops*, new genus, new species Type

*Type*.—U.S.N.M. no. 98903. (3696.) D. 5387. Bagatao Island Light (outer), S.  $80^{\circ}$  E., 27 miles (lat.  $12^{\circ}54'40''$  N., long.  $123^{\circ}20'30''$  E.), between Burias and Luzon. In 209 fathoms. March 11, 1909. Length 109 mm. Also a series of paratypes, in depths from 37 to 340 fathoms.

*Remarks*.—Philippines, East Indies. A very distinct form, easily known by its very large eyes and incomplete lateral line, also the strong armature of the head. Several of the specimens with rather large lerneans attached to the eye. In young black dorsal spot very contrasted and extends over all membranes involved.

(μέγας, large+ὤψ, eye.)

#### HIPPOSCORPAENA, new genus

*Type*.—*Hipposcორpaena filamentosa*, new species.

Body deepest at hind part of head, slopes rapidly down behind. Head very large, compressed, deep, inclined forward. Snout very long, well compressed, with well concave profile, end in front as protuberance. Eye small, greatly elevated and orbital socket well



protruded above in upper profile of head. Mouth rather small, low, lower jaw shallow and little protruded in front. Teeth obsolete. Maxillary greatly expanded behind. Interorbital deeply concave. Gill rakers short low tubercles. Scales small, smooth, adherent. Lateral line complete, axial, with rather large tubes. Head and body with skinny flaps. Fin rays simple. Two dorsals, separating notch deep and front rays of first fin highest. Anal opposite soft dorsal, base little shorter. Caudal rather long, lower rays longest. Pectoral large. Ventral inserted well before pectoral, smaller.

Resembles *Taenianotus* Lacépède, but with much deeper body, very different physiognomy, well-separated dorsals, and advanced ventrals. (*ἵππος*, horse + *Scorpaena*)

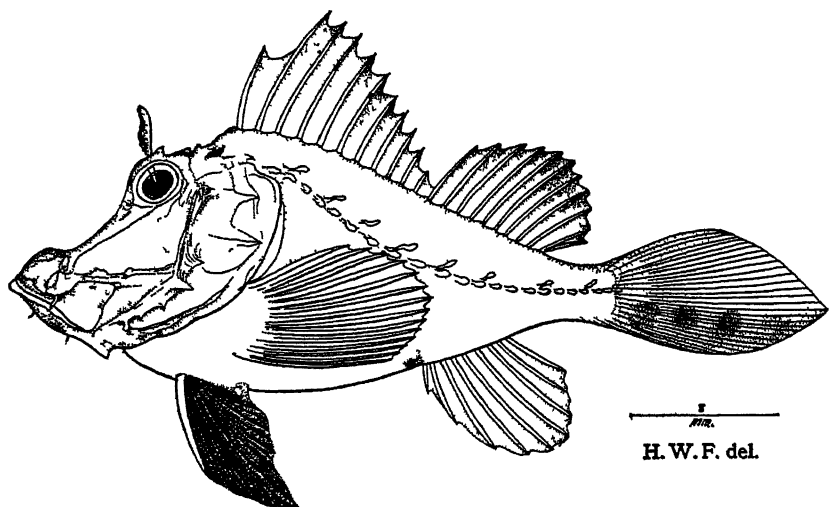


FIGURE 31.—*Hipposcorpaena filamentosa*, new genus, new species Type

**HIPPOSCORPAENA FILAMENTOSA, new species**

FIGURE 31

Depth  $2\frac{1}{4}$ ; head  $2\frac{1}{10}$ , width  $2\frac{1}{2}$ . Snout  $1\frac{1}{10}$  in head from snout tip; eye  $6\frac{1}{4}$ ,  $3\frac{1}{4}$  in snout, greater than interorbital; maxillary not quite reaching opposite front eye edge, expansion 3 in snout, length  $2\frac{4}{5}$  in head from snout tip; interorbital  $1\frac{1}{3}$  in eye; preopercle edge with 4 divergent spines, upper 2 largest. Gill rakers 6 + 11 low spinescent tubercles, about half of gill filaments, which half of eye.

Scales about 30 counted along lateral line to caudal base; tubes 22 in lateral to caudal base and 2 more on latter; 6 scales above, 15 below. No distinct scales on head. Supraorbital flap simple, little longer than eye. Close along and above lateral line row of 8 rather long cutaneous flaps.

D. XI, 10, second spine 2 in total head, fifth ray  $2\frac{3}{4}$ ; A. 9, fifth ray  $2\frac{2}{5}$ ; caudal  $1\frac{1}{3}$ , rays branched and lower longer; least depth of caudal peduncle  $4\frac{7}{8}$ ; pectoral  $1\frac{3}{5}$ , rays 14; ventral rays, I, 5, fin  $1\frac{4}{5}$  in total head length.

Brown generally. Iris gray. Fins mostly paler than body, except black ventrals and lower part of caudal with longer rays. Supra-ocular flap dark.

*Type*.—U.S.N.M. no. 98819. D. 5253. Linao Point, N.  $22^{\circ}$  E., 1.5 miles (lat.  $7^{\circ}4'48''$  N., long.  $125^{\circ}39'38''$  E.), Gulf of Davao. In 28 fathoms. May 18, 1908. Length 38 mm.

(*filamentosa*, with filaments.)

#### NEMAPONTINUS, new genus

*Type*.—*Nemapontinus tentacularis*, new species.

Body well compressed, ovate. Head large, compressed. Muzzle long, conic, longer than snout. Eye little advanced from middle of head, impinging little on upper profile. Mouth large, lower jaw slightly protruding. Maxillary reaches below eye, well expanded behind. Teeth in villiform bands in jaws and on vomer, none on palatines. Armature of head prominent, spines all well developed. Gill opening large, deeply cleft, membranes divided, free. Gill rakers lanceolate. Scales small, in oblique or inclined series on body, ctenoid. Lateral line complete, axial along side of body. Dorsals united, anterior spines highest. Soft dorsal rounded. Anal with 3 spines, of which second largest. Caudal rounded convexly behind. Pectoral with deep base, rays all simple, fin rather large. Ventral moderate, inserted little before pectoral origin.

Closely related to *Pontinus* Poey, but differs in the very long supra-orbital tentacles.

( $\nu\eta\mu\alpha$ , thread + *Pontinus*.)

#### NEMAPONTINUS TENTACULARIS, new species

##### FIGURE 32

Depth  $2\frac{3}{4}$  to 3; head  $1\frac{9}{10}$  to  $2\frac{1}{10}$ , width  $2\frac{1}{6}$  to  $2\frac{1}{5}$ . Snout  $3\frac{1}{8}$  to  $3\frac{5}{8}$  in head from snout tip; eye  $4\frac{1}{5}$  to  $4\frac{3}{4}$ ,  $1\frac{1}{4}$  in snout, nearly twice as wide as interorbital; maxillary reaches  $\frac{1}{2}$  to  $\frac{3}{5}$  in eye, expansion  $1\frac{1}{2}$  to  $1\frac{4}{5}$  in eye, length  $2\frac{1}{3}$  to  $2\frac{1}{6}$  in head from snout tip; teeth finely villiform, in broad bands in jaws and on vomer, none on palatines; interorbital  $9\frac{3}{4}$  to 11, deeply concave. Gill rakers 6 + 13, moderate, of which 4 above and 6 below rudimentary tubercles; equal gill filaments or 3 in eye.

Pair of small, strong, nasal spines; pair of antero-supraorbital spines and 3 pairs of postero-supraorbital spines, followed by pair of

well developed occipital and nuchal spines: strong postorbital spine, followed by another more posterior and close to smaller one on supra-scapula; 2 preorbital spines, posterior larger and directed backward; suborbital stay with 4 spines, of which first on preorbital; 4 preopercular spines, upper largest and with small prebasal spine; 2 wide set opercular spines, larger above, opposite one another; strong humeral spine.

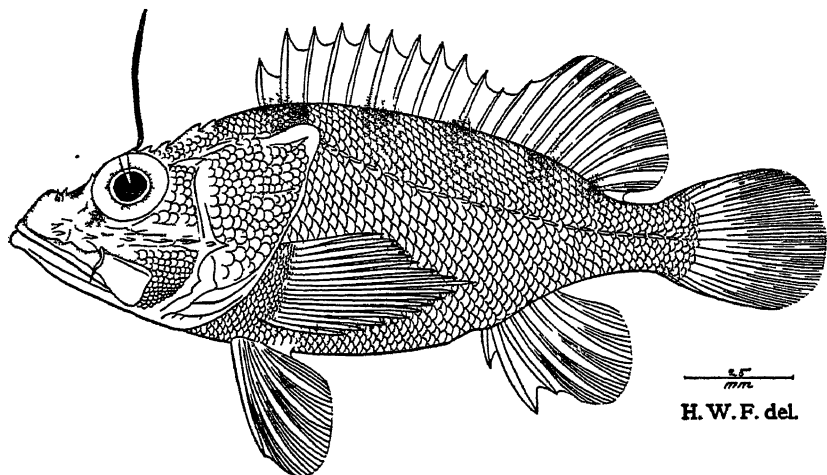


FIGURE 32—*Nemapontinus tentacularis*, new genus, new species Type.

Scales 42 to 45+3 close above and along lateral line; tubular scales 23 to 29+1 or 2 in lateral line; 8 scales above, 12 to 14 below; 14 to 17 predorsal; 3 postoculars. Scales very small on breast, chest, prepectoral region, also on caudal base. Lateral line complete, axial; tubes long, slender, simple, well exposed. Scales on cheek and postocular smaller than others on opercle and top of head, which otherwise naked. Long supraorbital filament  $2\frac{1}{5}$  in total head length (less developed or absent in small examples). Small filament at antero-supraorbital spine, also one at each preorbital spine. Scales with 11 to 14 short marginal radiating basal striae; 48 to 50 fine apical denticles, slender, with 3 transverse series of basal elements; circuli fine.

D. XII, 9, 1, fourth spine  $3\frac{1}{8}$  to 4 in total head length, fourth ray  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; A. III, 5, 1, second spine  $2\frac{3}{4}$  to  $3\frac{1}{5}$ , second ray  $2\frac{1}{3}$  to  $2\frac{3}{4}$ ; caudal 2, convex behind; least depth of caudal peduncle 5; pectoral  $1\frac{3}{8}$  to  $1\frac{7}{8}$ , rays 16; ventral rays I, 5, fin 2 to  $2\frac{1}{10}$  in head from snout tip.

Brown, clouded obscurely with paler and darker. Five dark saddles along edge of back, but little reflected on bases of fins. Iris pale, with some grayish. Supraorbital tentacle blackish. Fins all

pale or light brown. Some obscure brownish cloudings on spinous dorsal, especially on sixth to eighth membranes.

*Type*.—U.S.N.M. no. 98887. (3143.) D. 5519. Point Tagolo Light, S. 71° W., 8.7 miles (lat. 8°47' N., long. 123°31'15" E.), northern Mindanao and vicinity. In 182 fathoms. August 9, 1909. Length 185 mm.

*Paratypes*.—U.S.N.M. no. 99008. (3231, 3232.) D. 5279. Malavatu Island (W.), S. 18° W., 5.40 miles (lat. 13°57'30" N., long. 120°22'15" E.), China Sea, vicinity of southern Luzon. In 117 fathoms. July 17, 1908. Length 158 to 168 mm. Two examples. (*tentacularis*, with tentacles.)

#### CROSSOSCORPAENA, new genus

*Type*.—*Sebastes hexanema* Günther.

Body elongately ovoid, rather slender. Head large, pointed. Snout long, little convex in profile. Eye large, well impinging on upper profile of head, largely premedian. Mouth little inclined, lower jaw slightly projecting. Maxillary extends below eye, expanded terminally. Interorbital narrow. Teeth in jaws and on palate. Armature of head well developed. Scales small, especially on chest, breast, and prepectoral region. Head largely scaly, muzzle naked. Few short filaments on head and row along lateral line. Dorsal continuous, spinous section with longer base though longest spines lower than soft dorsal, membrane entire, spines 12. Anal, with 3 spines, shorter than rays. Caudal truncate. Pectoral small, also ventral.

Small rosy fishes of the East Indies, chiefly characterized by the row of small filaments along the entire course of the lateral line.

(*ἁροσσοί*, fringe + *Scorpaena*.)

#### MACROSCORPIUS, new genus

*Type*.—*Macroscorpius pallidus*, new species.

Body elongate, slender, moderately compressed, deepest at spinous dorsal origin. Head large, conic, elongate. Snout long, conic. Eye high, rather small, before middle in head. Mouth large, inclined little from horizontal. Jaws about equal, with broad dental area of upper jaw exposed. Mandible scarcely or not protruding, with broad bony spur at symphysis. Teeth fine, roughly granular, sharp points prickly to touch; narrow band on vomer and each palatine. Interorbital low, nearly level. Gill opening wide, but slightly joined to isthmus. Gill rakers lanceolate, moderate. Bones of head all more or less cavernous, with sharp though small and inconspicuous spines. Scales caducous, cycloid. Head largely naked. Bases of caudal and pectoral scaly. Lateral line complete, conspicuous canai,

with large pores few in number, axial along upper side of body. Dorsals separated, membranes of spinous fin entire to ends of spines; soft fin nearly or quite high as first dorsal. Anal similar, smaller and opposite, with 2 slender spines, second larger and longer. Caudal moderate, rudimentary rays well developed. Pectoral long, reaches to or little in anal, especially in young, with broad base, simple rays nearly half number of fin rays. Ventral inserted slightly before pectoral origin, fin rather small.

Apparently differs from *Lioscorpius* Günther in the presence of but 2 anal spines, a character not shared by any species of *Setarches*. *Setarches remiger* (Gilbert and Cramer) differs further not only in its 3 anal spines, but also the deeper body, more dorsal spines, and the dorsal fins joined; moreover its pectoral is longer and its scales are very small.

(μακρός, long + σκορπιος, scorpion.)

MACROSCORPIUS PALLIDUS, new species

FIGURE 33

Depth 4 to  $4\frac{1}{5}$ ; head  $2\frac{1}{6}$  to  $2\frac{1}{4}$ , width 2 to  $2\frac{1}{3}$ . Snout  $2\frac{7}{8}$  to 3 in head from snout tip; eye 6 to  $6\frac{3}{4}$ ,  $1\frac{7}{8}$  to  $2\frac{1}{5}$  in snout, 1 in inter-orbital; orbit 4 to  $5\frac{2}{3}$  in head from snout tip,  $1\frac{3}{5}$  to  $1\frac{3}{4}$  in snout; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  in eye, expansion  $1\frac{1}{5}$  to  $1\frac{1}{4}$ , length  $1\frac{9}{10}$  to 2 in head from snout tip; bands of villiform teeth broad in jaws, narrow on vomer and palatines, with series of latter long; interorbital 6 to  $6\frac{3}{5}$ , low, convex. Gill rakers 7+10, of which 3 or 4 above and below rudiments; gill filaments  $\frac{7}{8}$  of gill rakers which  $1\frac{1}{4}$  in eye.

Pair of very small, close-set nasal spines; small antero-supraorbital spines rather low each side; occipito-nuchal ridge long, fused, each ending in a small nuchal spine behind 2 postocular spines, posterior larger and above upper end of vertical preopercle edge; suprascapular spine rather large; 2 preorbital spines, both directed backward and posterior larger; suborbital stay with 1 or 2 feeble spines, ends in one behind and another little above terminal one; 5 rather short, strong, preopercular spines; 2 small divergent opercular spines, about opposite. No humeral spine.

Scales 40+4 close above and along lateral line; tubular scales 28+3 in lateral line; 6 scales above, 12 below; 10 predorsal forward to occiput. Cheeks, opercle and postocular scaly. Small scales on chest, breast, prepectoral and belly. Scales with 7 basal radiating striae; circuli fine.

D. X-I, 10, 1, fourth spine 3 to  $3\frac{1}{5}$  in total head, second ray  $2\frac{3}{4}$  to  $3\frac{1}{8}$ ; A. II, 6, 1, second spine  $4\frac{3}{4}$  to 5, third ray 3 to  $3\frac{1}{5}$ ; caudal  $1\frac{5}{8}$  to  $1\frac{7}{8}$ , slightly concave behind; least depth of caudal peduncle  $6\frac{1}{8}$  to

$6\frac{1}{2}$ ; pectoral  $11\frac{1}{4}$  to  $11\frac{1}{3}$ , rays II, 14, IX; ventral rays I, 5, fin  $21\frac{1}{2}$  to  $21\frac{1}{2}$  in total head.

Pale brownish, nearly uniform, fins all paler or nearly whitish. Iris light grayish. Peritoneum blackish.

*Type*.—U.S.N.M. no. 98890. D. 5518. Point Tagolo Light, S.  $64^{\circ}$  W., 8.7 miles (lat.  $8^{\circ}48'$  N., long.  $123^{\circ}31'$  E.), northern Mindanao and vicinity. In 200 fathoms. August 9, 1909. Length 169 mm.

Also a series from the Philippines in 162 to 226 fathoms.

(*pallidus*, pale.)

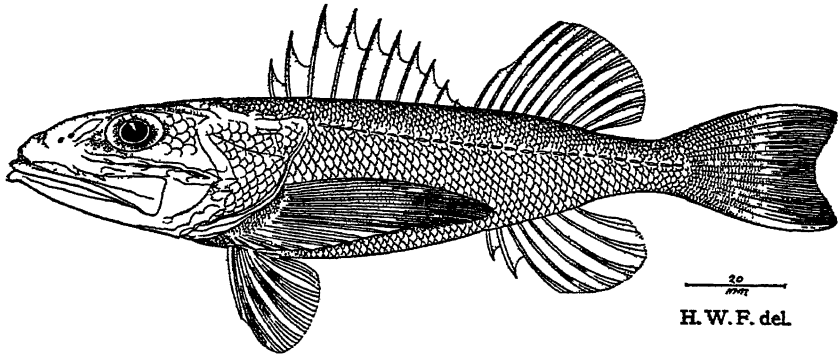


FIGURE 33—*Macroscorpius pallidus*, new genus, new species. Type

#### PTEROPELOR, new genus

*Type*.—*Pteropelor noronhai*, new species.

Body well compressed, ovate. Head large, well compressed, with prominent cranial ridge. Snout compressed, deeply concave in profile, moderate. Eye moderate, elevated, well impinging on upper profile, elevated, little advanced in head. Mouth large, lower jaw protruding. Maxillary reaches below eye. Cranium with deep pit behind eyes. Spines of head distinct, not especially prominent. Gill opening wide, membranes only narrowly connected. Gill rakers tuberculate. Scales rather large, deciduous, cycloid. Lateral line distinct only anteriorly. Long supraorbital flap. Dorsals deeply notched and spinous fin higher and well set off from soft fin; each membrane of spinous dorsal at least half notched terminally. Anal like soft dorsal. Caudal elongate, rounded. Pectoral moderate, reaches into anal fin. Ventral small, inserted well before pectoral, only reaches half way in pectoral.

Somewhat with the aspect of *Inimicus* and also seems closer to *Pterodichthys*, from which it differs in its incised spinous dorsal membranes, absence of barbels, and large scales.

(πτερόν, fin + *Pelor*.)

*PTEROPELOR NORONHAI*, new species

FIGURE 34

Depth  $2\frac{7}{8}$  to 3; head  $2\frac{1}{8}$  to  $2\frac{1}{6}$ , width 2. Snout 3 to  $3\frac{1}{10}$  in head from snout tip; eye  $4\frac{1}{4}$  to  $4\frac{2}{5}$ ,  $1\frac{2}{5}$  to  $1\frac{1}{2}$  in snout, greatly exceeds interorbital; maxillary reaches  $\frac{1}{3}$  to  $\frac{2}{5}$  in eye, expansion  $1\frac{1}{2}$ , length 2 in head from snout tip; bands of minute villiform teeth in jaws, and triangular patch on vomer, none on palatines; interorbital 6 to 7, deeply concave. Gill rakers 6+12, though only 6 lower developed, others as rudiments; length  $\frac{3}{5}$  of gill filaments, which  $2\frac{1}{2}$  in eye.

Pair of small nasal spines; 3 pairs of supraorbital spines, as antero-supraorbital pair, and 2 elevated postero-supraorbital pairs, of which posterior much larger; very small pair of coronal spines, then pair of occipital and nuchal spines close; row of 3 postocular spines, fol-

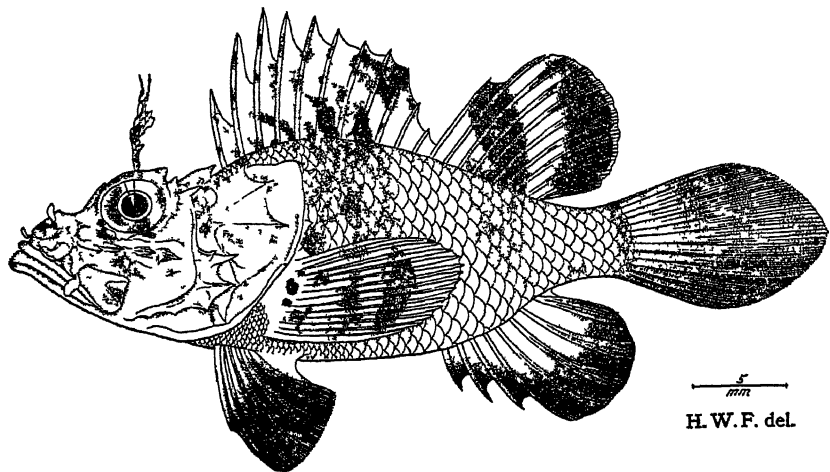


FIGURE 34.—*Pteropelor noronhai*, new genus, new species. Type.

lowed by suprascapular spine; preorbital spine directed little backward; suborbital stay with 3 spines, preceded by median preorbital spine; 4 distinct spines on preopercle edge, second below end of preorbital stay largest; 2 divergent opercular spines, opposite one another; strong humeral spine.

Scales 25+3 along course of lateral line (as computed to caudal base); lateral line of only 5 or 6 scales anteriorly, sloping down axially and tubes long, slender, and well exposed; 4 or 5 scales above, 7 below. Head naked. Chest, breast, and prepectoral region naked. Scales small on belly. Nasal tentacle long as eye; supraorbital tentacle nearly twice long as eye; several filaments on each mandibular ramus, anterior longest; long flap to preorbital spine.

D. XII, 9, 1, fifth spine  $1\frac{7}{8}$  in total head length, third ray  $1\frac{4}{5}$  to 2; A. III, 5, 1, third spine  $3\frac{1}{8}$  to  $3\frac{1}{2}$ , third ray  $1\frac{7}{8}$  to 2; caudal  $1\frac{1}{3}$  to  $1\frac{1}{2}$ , inframedian rays longest; least depth of caudal peduncle  $4\frac{3}{4}$  to  $4\frac{4}{5}$ ; pectoral  $1\frac{3}{4}$ , rays 15, all simple, and membranes deeply incised terminally; ventral with spine and 5 rays. fin  $1\frac{3}{5}$  to 2 in total head length.

Brown, obscurely clouded darker on head above and below each dorsal on back. Spinous dorsal with membranes dark gray terminally and dark blotches basally. Soft dorsal with dark gray median blotch and terminally blackish gray. Pectoral with 2 dark brown blotches. Other fins more or less gray black terminally.

*Type*.—U.S.N.M. no. 98892. D. 5310. Lat.  $21^{\circ}33'$  N., long.  $116^{\circ}13'$  E., China Sea, vicinity of Hong Kong. In 100 fathoms. November 4, 1908. Length 44 mm. (688.)

*Paratype*.—U.S.N.M. no. 99009. D. 5310. Same data. Length 48 mm.

(For Dr. Adolfo Cesar di Noronha, of Madeira.)

#### BRACHYPTEROIS, new genus

*Type*.—*Brachypterois serrulifer*, new species.

Known by its short dorsal spines, shorter than soft dorsal rays. Caudal long and pointed. Long pectoral reaches near caudal base. Ventral half long as pectoral. Preorbital depth half of eye. Ridges of head serrulate, including mandible. Eye greatly longer than snout. No flaps or cirri.

Differs from *Ebosia*, to which it is related, in its entirely different physiognomy.

(*βραχίς*, short + *Pterois*; with reference to the short dorsal spines.)

#### BRACHYPTEROIS SERRULIFER, new species

#### FIGURE 35

Depth  $2\frac{3}{4}$ ; head  $2\frac{1}{3}$ , width 2. Snout  $4\frac{1}{3}$  in head from snout tip; eye  $3\frac{3}{5}$ , much greater than snout or interorbital; maxillary reaches  $\frac{2}{5}$  in eye, expansion  $1\frac{1}{3}$ , length 2 in head from snout tip; bands of very minute, fine, villiform teeth in jaws, also small patch each side of head of vomer, and palatines toothless; interorbital 7, concave, with rather deep median longitudinal groove. Gill rakers 5+11, with 3 above and below rudiments; length equals gill filaments or  $\frac{1}{3}$  of eye.

No nasal spines; supraorbital ridge finely serrated; parietal occipital ridge continuous, edge finely serrated; postocular ridge high, its edge serrated; lower edge of preorbital with 5 spines all directed down; ridge of suborbital stay serrated its whole length; preopercular edge with 5 rather prominent denticles, upper 2 directed back



and all others directed downward, also lower with several smaller or auxiliary denticles; lower inner edge of each mandibular ramus finely serrated.

Scales 40+4 close above along lateral line; tubes 25+1 in lateral line; 5 scales above lateral line to base of third dorsal spine, 11 below to anal origin; 15 predorsal opposite front pupil edge; 3 postocular scales; 4 obliquely back from lower eye edge to angle of preorbital stay and 8 below latter in vertical series behind maxillary; 7 rows transversely over maxillary expansion. Small scales on caudal and pectoral basally, also small on chest and breast. Scales with 10 or 11 basal radiating striae; edge with several coarse or obtuse points apically; circuli very fine, obsolete apically.

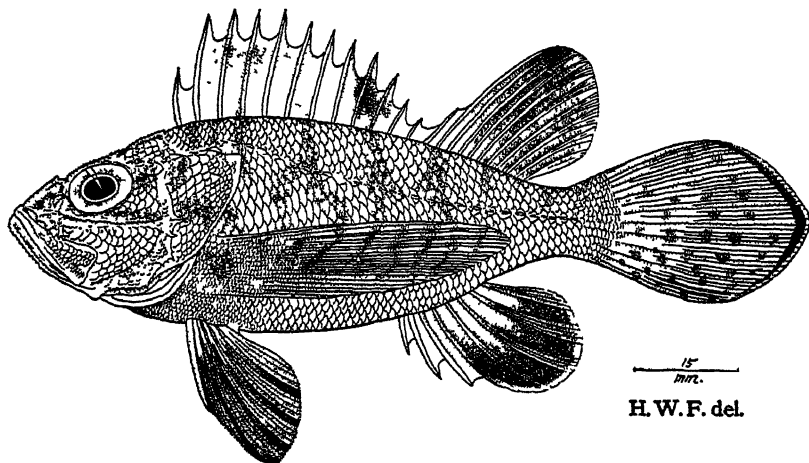


FIGURE 35.—*Brachypteros serrulifer*, new genus, new species. Type.

D. XII-I, 1, 9, 1, fourth spine  $2\frac{1}{4}$  in total head length and membranes apparently entire well toward tips of spines, third branched ray  $1\frac{3}{4}$ ; A. III, 5, 1, third spine  $2\frac{2}{3}$ , third ray  $1\frac{4}{5}$ ; caudal 1, ends in median point behind: least depth of caudal peduncle  $4\frac{1}{8}$ ; pectoral reaches  $1\frac{1}{2}$  to caudal base or its length  $1\frac{7}{8}$  in fish without caudal, rays II, 6, VI; ventral rays I, 5, fin  $1\frac{1}{2}$  in head.

Brown, with 6 darker, narrow, ill defined, transverse cross bands on back and upper sides. Three dark brown bars radiate down from eye, first at middle of lower edge, second from lower hind edge and third back over postocular. Large blackish brown blotch on opercle, nearly size of eye. Iris gray. Spinous dorsal gray marginally. Paired fins dark gray medially, on membranes, edges and rays pale to whitish. Soft dorsal, anal and caudal whitish, with some obscure gray spots terminally.

*Type*.—U.S.N.M. no. 98886. (3177.) D. 5442. San Fernando Point Light, N.  $39^{\circ}$ E., 8.4 miles (lat.  $16^{\circ}30'36''$  N., long.  $120^{\circ}11'6''$  E.), west coast of Luzon. In 45 fathoms. May 10, 1909. Length 115 mm.

(*serrula*, a little tooth + *fero*, to bear.)

#### NEMAPTEROIS, new genus

*Type*.—*Nemapterois biocellatus*, new species.

Known by its extraordinary long preorbital barbel. Dorsal spines moderate. Pectoral moderately long. Each dorsal spine with greater terminal part free, expanded before and behind and main part of spine forming distinct midrib.

(*νημα*, thread + *Pterois*.)

#### NEMAPTEROIS BIOCELLATUS, new species

##### FIGURE 36

Depth  $2\frac{3}{4}$ ; head  $2\frac{2}{3}$ , width 2. Snout  $3\frac{1}{4}$  in head from snout tip; eye 3, greater than snout, over twice width of interorbital; maxillary reaches  $\frac{1}{4}$  in eye, expansion  $1\frac{1}{2}$  in eye, length 2 in head from snout tip; bands of minute villiform teeth in jaws and on vomer, none on palatines; interorbital  $2\frac{1}{2}$  in eye, very deeply concave. Gill rakers 4+11, compressed, low, short, half of gill filaments, which  $\frac{1}{3}$  of eye.

No nasal spines; low antero-supraorbital spine each side, and pair of higher postero-supraorbital spines each side, followed by pair of rather wide set coronal spines, then strong close-set parietal and occipital pairs (right parietal spine atrophied); low postocular keel over preopercle ends in small point, followed by another over opercle and finally suprascapular spine; ridge of suborbital stay without distinct spines; no preorbital spines; preopercle edge with 3 spines, short, obtuse, upper largest and opposite end of ridge of suborbital stay; opercle with single rather large spine; no humeral spine.

Scales 41+2 close above along lateral line; tubes 23+1 in lateral line; 6 scales above lateral line, 14 below; 14 predorsal forward to middle of interorbital; 2 postocular to preopercle ridge; 8 below ridge of preorbital stay on cheek. Scales small and crowded on chest, breast, prepectoral, belly, and bases of pectoral and caudal fins. Anterior nostril with pointed, fringed tentacle. Short lobate supraorbital flap behind second postero-supraorbital spine; broad flap above uppermost preopercular spine and several others below along preopercular edge. Short preorbital flap anteriorly, followed by long tentacle reaching back opposite pectoral origin. No flaps on fins or along lateral line. Lateral line complete, distinct,

little high at first, nearly axial along side of body; tubes large, simple. Scales with 8 to 14 basal radiating striae; 26 to 32 apical denticles; circuli fine, coarser or abruptly terminated apically.

D. XIII, I, 8, 1, sixth spine  $1\frac{2}{5}$  in total head length, second branched ray  $1\frac{9}{10}$ ; A. III, 5, 1, third spine  $1\frac{7}{8}$ , first ray  $1\frac{1}{2}$ ; caudal  $1\frac{2}{5}$ , convex behind; least depth of caudal peduncle  $3\frac{1}{3}$ ; pectoral reaches  $1\frac{1}{3}$  to caudal or  $2\frac{1}{10}$  in fish without caudal, rays III, 7, IX; ventral rays I, 5, fin  $1\frac{1}{6}$  in total head length.

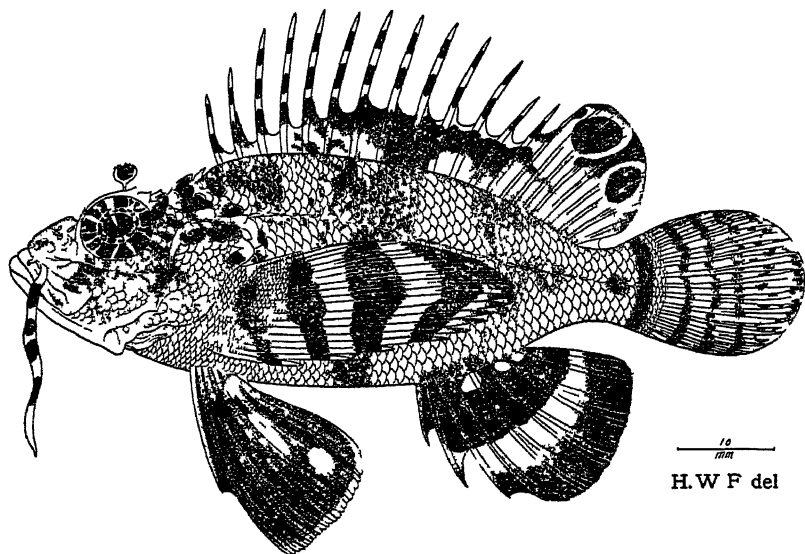


FIGURE 36—*Nemapterois biocellatus*, new genus, new species Type

General tint dull flesh color to light pink. Brown blotch on front of snout, followed by broad, white band from front of eye down to maxillary. Brown bar down from lower eye edge to maxillary expansion and another posteriorly down to lower part of opercle and subopercle, interval of lower cheek lighter brown. Obscure narrow brown bar crosses lower surface of head from each side behind end of maxillary. Dark band across front of interorbital and another broader over its median area. White lines radiate in orbit from iris. Supraorbital flap white, with round black spot in expansion. Two dark brown bands, narrowly separated, cross postocular part of head and posteriorly just before dorsal a third broader one, last reflected down behind opercular spine. From middle of spinous dorsal broad blackish brown band down to belly and another from soft dorsal base to anal; these bands all reflected on bases of dorsals to join dark areas on fins, also last reaches anal. Dorsals white, spinous fin with 3 longitudinal dark brown bands, with upper 2 series marked

as dark bars on free portions of spines; on soft dorsal lowest band continued only as subbasal obscure narrow streak. Two large black, white edged ocelli on outer part of soft dorsal, upper little larger or slightly smaller than orbit. Anal blackish brown with median white band and posterobasally fin also pale. Caudal white, with dark transverse basal band and 5 transverse dark brown narrow bands, made up of series of spots or short bars only on rays. Pectoral white, with 4 black transverse bands. Ventral black, edged anteriorly and below narrowly with white and 2 white spots in posterior part of fin. Preorbital tentacle white, with 4 black bars.

*Type*.—U.S.N.M. no. 98894. (2072.) D. 5136. Jolo Light, S. 37° E., 0.70 mile (lat. 6°04'20" N, long. 120°59'20" E). February 14, 1908. Depth 22 fathoms. Length 83 mm.

Characters expressed in the genus readily distinguish the species. (*bis*, two + *ocellus*, eyelike spot.)

#### SCORPAENELLA, new genus

*Type*.—*Scorpaenella cypho*, new species.

Body deeply ovoid, compressed, with back well elevated anteriorly. Head large, compressed. Snout short, obtuse. Eye large, before middle in length of head, scarcely impinging on upper profile. Mouth large, little inclined and lower jaw scarcely projects. Maxil-

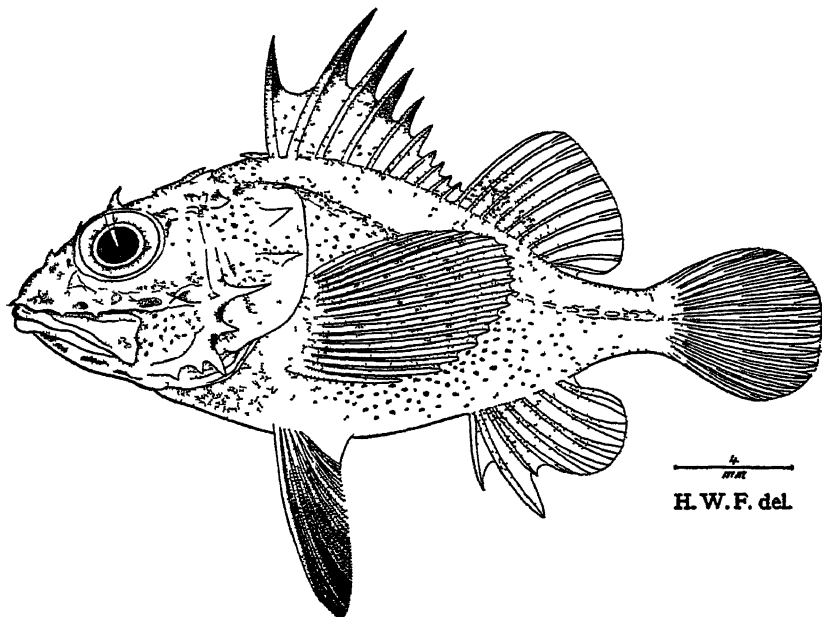


FIGURE 37—*Scorpaenella cypho*, new genus, new species Type

lary reaches below eye, expanded posteriorly. Teeth minute, villiform, in narrow bands in jaws, apparently present on vomer, but none on palatines. Interorbital low. Spines of head well developed, some quite long and conspicuous. Gill openings wide, membranes free and separate. Gill rakers slender, lanceolate, rather long. No scales. Lateral line complete, prominent, its course rather high. Dorsal spines elevated and fin well notched or separated from soft dorsal, also each membrane between spines deeply incised terminally. Soft dorsal posterior, about half size of spinous fin. Anal opposite soft dorsal, similar, smaller, with 3 spines, second longest and first longer than third. Caudal rounded. Pectoral large, with broad base, simple rays slender and well united by membranes. Ventral inserted opposite pectoral origin, with long spine.

A genus of small scorpaenoids suggestive of *Lythrichthys* and *Pterodichthys*, but with entirely different physiognomy and without any scales.

(*Scorpaenella*, diminutive of *Scorpaena*.)

SCORPAENELLA CYPHO, new species

FIGURE 37

Depth  $2\frac{2}{5}$ ; head  $2\frac{1}{4}$ , width  $1\frac{7}{8}$ . Snout 4 in head from snout tip; eye 4, equals snout, greater than interorbital; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{8}$  in eye, length  $1\frac{3}{4}$  in head from snout tip; interorbital 5, level. Gill rakers 3+10, rather small or 3 times long as gill filaments, which  $1\frac{1}{2}$  in eye.

Pair of small nasal spines; very small and low antero-supraorbital spine; large, high, prominent medio-supraorbital spine; pair of very small postero-supraorbital spines; occipital-nuchal keel ends behind in single pair of (nuchal) spines; 3 divergent preorbital spines each side, anterior largest and directed forward; suborbital stay with 3 low spines; preopercular spines 5, upper largest on head or about  $1\frac{3}{5}$  in eye; single postocular spine and 1 at suprascapula; 2 rather widely divergent opercular spines, lower little posterior.

Skin smooth. Pores in lateral line 21 (last part of course damaged), in membranous canal extending whole course. No filaments or flaps.

D. X, 9, third spine 2 in total head length, first branched ray 3; A. III, 5, second spine  $2\frac{2}{3}$ , second ray  $3\frac{1}{5}$ ; caudal  $2\frac{1}{5}$ , convex behind; least depth of caudal peduncle 5; pectoral  $1\frac{1}{3}$ , rays 17?; ventral rays I, 5, spine  $1\frac{1}{5}$  in total head.

Largely uniform brown, with obscure darker specks or spots on trunk and tail. Iris grayish. Fins pale. Ventral rays darker terminally.

*Type*.—U.S.N.M. no. 98899. D. 5618. March Island, S.  $69^{\circ}$  E., 7.8 miles (lat.  $0^{\circ}37'0''$  N., long.  $127^{\circ}15'0''$  E.), Molucca Passage. In 417 fathoms. November 27, 1909. Length 27 mm.

(*κῦφός*, hunchbacked.)

### Genus INIMICUS Jordan and Starks

According to Jordan and Starks this genus differs from *Pelor* chiefly in the absence of long filamentous tips to the upper rays of the pectorals. The head is also more depressed and of slightly different shape. Evidently the two species they admit are referable to only one, *Inimicus aurantiacus*, differing chiefly in its orange color, or blackish tinged with orange, but without distinct cross bands.

#### INIMICUS BIFILIS, new species

FIGURE 38

Depth 4: head  $2\frac{3}{4}$ . Snout  $2\frac{2}{5}$  in head from snout tip; eye  $5\frac{1}{5}$ ,  $2\frac{1}{5}$  in snout; maxillary reaches  $\frac{2}{3}$  to eye, expansion  $1\frac{1}{4}$  in eye; length in profile  $3\frac{1}{5}$  in head from snout tip; interorbital narrow, deeply concave, width about equals eye.

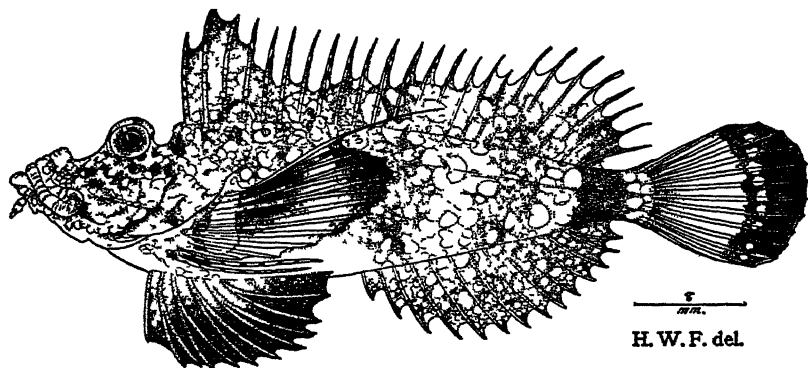


FIGURE 38.—*Inimicus bifilis*, new species. Type.

Body with smooth skin. Head with many irregularities, ridges, knobs, and caruncles. Several flaps on mandible.

D. XVII, 8, first spine inserted at first third in postocular, second spine  $1\frac{7}{8}$  in total head length, third ray  $1\frac{7}{8}$ ; marginal ends of all dorsal membranes deeply cleft; A. 13, fifth ray  $2\frac{1}{5}$ ; caudal  $1\frac{2}{5}$ , rounded behind; least depth of caudal peduncle  $4\frac{4}{5}$ ; pectoral  $1\frac{1}{2}$ , rays I, 3, VI–II, uppermost simple ray elongate, filiform, reaches  $1\frac{4}{5}$  to caudal; ventral I, 5, fin length  $1\frac{1}{5}$  in total head length, last ray broadly adnate by membrane with belly.

Brown, paler below and with 3 pale transverse diffuse areas on body. Fins more or less brownish. Dorsals and anals, also head and body, with obscure pale to whitish spots and blotches, very variable. Caudal blackish on outer portion, with row of small whitish spots transversely. Pectoral with broad white subbasal band, adjoining blackish area over branched rays and another terminally; lower detached rays with dark spots. Ventral blackish, little paler basally.

*Type*.—U.S.N.M. no. 98905. (22403.) Canmahala Bay. March 11, 1909. Length 57 mm.

*Remarks*.—Greatly like *Inimicus filamentosus*, but only the uppermost pectoral ray ending in a filament, which reaches well beyond the depressed pectoral fin.

(*bis*, two + *filum*, thread.)

## Family APLOACTIDAE

### ANALYSIS OF GENERA

- $\alpha^1$ . Preorbital with 2 strong spines both projecting back behind eye; A. I, 7; ventral I, 2----- **AcanthospheX**  
 $\alpha^2$ . Preorbital with single strong spine; A. spines III; ventral I, 4 or 5----- **Prosopodasys**  
 $\alpha^3$ . No preorbital spine; first 3 dorsal spines not set off from rest of fin; D. VII, 15 to 18----- **Aploactoides**

### ACANTHOSPHEX, new genus

*Type*.—*Prosopodasys leurynnis* Jordan and Seale.

Body elongate ellipsoid, compressed. Head moderate, compressed. Fine teeth in jaws and on vomer, none on palatines. Two short barbels at chin. Suborbital spines long, both project backward behind eye. Preopercular spines all enlarged and long. Spines of first dorsal longest of dorsal series, first fin also separated from second spinous section. A single, feeble, short anal spine.

( $\alpha\kappa\alpha\theta\alpha$ , spine +  $\sigma\phi\eta\xi$ , wasp; with reference to the long spines of the head.)

### Genus PROSOPODASYS Cuvier

#### PROSOPODASYS CYPHO, new species

#### FIGURE 39

Depth  $2\frac{1}{2}$ ; head  $2\frac{1}{2}$ , width 2. Snout 4 in head from snout tip; eye 4, subequal with snout, greater than interorbital; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{3}$  to  $1\frac{1}{2}$ , length 2 in head from snout tip; patch of finely villiform teeth on vomer and each palatine; interorbital  $5\frac{1}{2}$ , moderately low, depressed or slightly concave; subopercular and uppermost preopercular spine subequal or  $\frac{1}{2}$  of eye;

preopercular spines 4. Gill rakers 3+7. short weak points,  $\frac{1}{3}$  of gill filaments, which  $\frac{1}{2}$  of eye.

Body covered with minute, close set, firmly adherent non-imbricate scales. Lateral line high, axial, incomplete on caudal peduncle, of 18 or 19 rather long, simple tubes.

D. III, X, 8 insertion of first spinous dorsal over hind eye edge, length  $\frac{1}{2}$  in space to end of second depressed spine, which  $1\frac{7}{8}$  in total head, third ray  $1\frac{1}{2}$ ; A. III, 5, third spine  $2\frac{2}{5}$ , third ray  $1\frac{7}{8}$ ; caudal  $1\frac{2}{5}$ , rounded behind; depth of caudal peduncle  $3\frac{1}{2}$ ; pectoral 1, rays I, 11; ventral rays I, 5, fin  $1\frac{3}{5}$  in total head length.

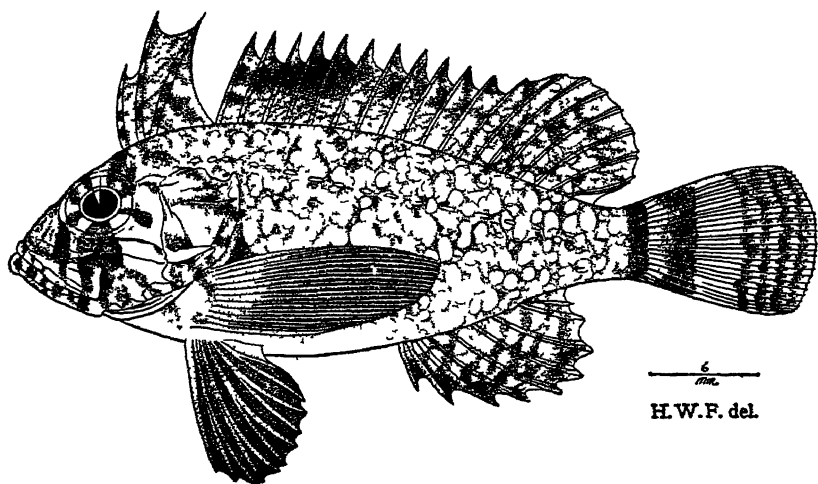


FIGURE 39.—*Prosopodasys cypho*, new species Type

Brown, slightly paler on head and belly below. Head with broad, whitish frontal band, one down from front of eye over maxillary expansion, another from hind eye edge over cheek and vertical limb of preopercle. White bar at pectoral base. Dorsals dark brown. Second dorsal with whitish longitudinal streak subbasal, above which on middle of fin from fifth to ninth spines broad blackish brown blotch. Soft dorsal with darker brown transverse waved lines or bars. On anal 3 or 4 broad, slightly darker transverse bands. Caudal with 2 brown bands crosswise, fin with posterior broader dark basal bar and 4 terminal waved dark transverse lines of bands intervening pale areas whitish. Paired fins blackish brown.

*Type*.—U.S.N.M. no. 98902. (19707.) Davao, Mindanao. May 16, 1908. Length 45 mm.

*Remarks*.—Distinguished by its elevated back, coloration, and proportions. It differs from *Prosopodasys trachinoides* as figured by



Bleeker in the dorsal origin over the hind eye edge; it is also quite different from both *P. zollingeri* and *P. trachinoides* in coloration.

(κνφός, hunchbacked.)

#### APLOACTOIDES, new genus

*Type.*—*Aploactoides philippinus*, new species.

Body elongate, well compressed, tapers back from head. Head rather small, compressed. Snout short, obtuse. Eye small, advanced until nearly before center in head length, high. Mouth small, broad, nearly vertical, opens upward. Maxillary very greatly inclined, not reaching eye, expanded behind. Teeth in villiform bands in jaws, very fine, bands moderately wide; small band of teeth on vomer, but none on palatines. Preopercle and preorbital armed with several rather long spines. Gill openings wide, free from isthmus. Gill rakers short, low tubercles or papillae. Skin smooth and rather loose, at least on fins. Lateral line high and close to upper edge of back. Head with short, small scattered filaments. Dorsal begins over hind part of eye, first spine larger than those immediately following, and spinous fin much shorter than soft dorsal. Anal like soft dorsal, only little smaller, both fins connected behind by membrane with caudal peduncle. Caudal elongate, rounded behind. Pectoral long, reaches anal, low, base fleshy. Ventral short, fins united about opposite hind edge of eye.

An interesting genus, differing from *Aploactis* in its short spinous dorsal and more advanced insertion of the ventrals.

(*Aploactis*+*ēidos*, resemblance.)

#### APLOACTOIDES PHILIPPINUS, new species

##### FIGURE 40

Depth 3 to  $3\frac{1}{2}$ ; head  $3\frac{2}{3}$  to  $3\frac{3}{4}$ , width  $1\frac{1}{2}$  to  $1\frac{3}{5}$ . Snout  $3\frac{1}{2}$  to 4 in head from snout tip; eye 5 to  $5\frac{1}{5}$ ,  $1\frac{3}{5}$  to  $1\frac{1}{2}$  in snout,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in interorbital; orbit 4 to  $4\frac{3}{4}$  in head from snout tip, equals snout, 1 to  $1\frac{1}{5}$  in interorbital; maxillary extends  $\frac{1}{2}$  to  $\frac{3}{5}$  in snout, expansion  $1\frac{1}{5}$  to  $1\frac{1}{2}$  in eye, length  $2\frac{1}{3}$  to  $2\frac{2}{5}$  in head from snout tip. Gill rakers as 6+10 low papillae, barely  $\frac{1}{8}$  of gill filaments, which equal eye.

Two strong, divergent preorbital spines, posterior much longer and equal eye; 4 preopercular spines, uppermost longest or equal eye. Few short filaments on chin.

Skin smooth, flabby, or rather loosely investing fins. Many fine, short, cutaneous points or flaps on head. Lateral line high, extends along upper part of back, with 14 pores, and apparently reaches to base of last dorsal ray.

D. VII, 15 to 18, first spine inserted over hind part of eye,  $2\frac{1}{4}$  to  $2\frac{7}{8}$  in total head length, tenth ray  $1\frac{2}{5}$  to  $1\frac{3}{5}$ ; A. II, 14 or 15, spines rather short, eighth ray  $1\frac{4}{5}$  to 2; last dorsal and anal rays adnate to caudal peduncle; depth of caudal peduncle 3; pectoral 1 in head to  $1\frac{1}{8}$  times head, rays 14 or 15; ventral rays I, 2, length 2 to  $2\frac{1}{4}$  in total head length.

Brown generally, mottled or shaded little darker on head and back and also fins, which blackish brown submarginally with edges of rays all very narrowly whitish and in contrast. Small black dots, irregular and variable, scattered over trunk, tail, and fins.

*Type*.—U.S.N.M. no. 98880. (3753.) D. 5504. Macabalan Point Light (Mindanao), S.  $39^{\circ}$  E., 6 miles (lat.  $8^{\circ}35'30''$  N., long.  $124^{\circ}36'$  E.), northern Mindanao and vicinity. In 200 fathoms. August 5, 1909. Length 119 mm.

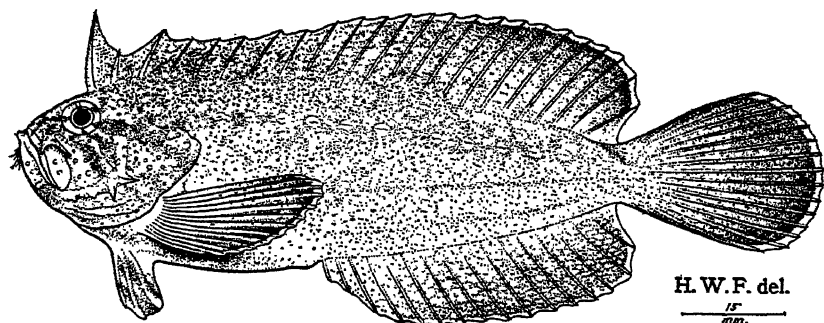


FIGURE 40.—*Aploactoides philippinus*, new genus, new species. *Type*.

Also a series paratypes, all from the Philippines, in 179 to 217 fathoms.

(Named for the Philippines.)

### Family PLATYCEPHALIDAE

#### GRAMMOPLITINAE, new subfamily

Type genus, *Grammoplites* Fowler.

Each scale of lateral line with a strong spine, continuous its entire length.

#### CYMBACEPHALINAE, new subfamily

Type genus, *Cymbacephalus*, new genus.

Conspicuous pit at hind orbital edge. Several supraorbital tentacles and one at front nostril. Two subequal preopercular spines.

**CYMBACEPHALUS, new genus**

*Type.*—*Platycephalus nematophthalmus* Günther.

Head moderately depressed, with strong ridges and high sharp spines. Teeth in jaws and on palate fine or villiform, without canines. Vomerine teeth in 2 parallel bands. Palatine teeth in band. One enlarged preopercle spine. Head largely scaly. Soft dorsal and anal with membranes entire.

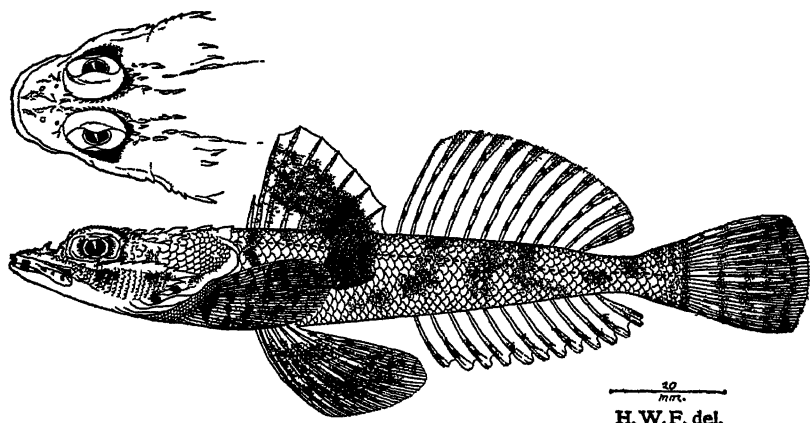
Distinguished chiefly by a large deep pit behind each eye. Eye with large branched, supraorbital tentacle.

(κύμβη, cavity + κεφαλή, head.)

**CYMBACEPHALUS ARMATUS, new species**

FIGURE 41

Depth  $6\frac{1}{2}$ ; head  $2\frac{7}{8}$ , width  $1\frac{1}{4}$ . Snout  $3\frac{3}{4}$  in head from snout tip; eye  $4\frac{2}{3}$ ,  $1\frac{1}{4}$  in snout, 5 times bony interorbital; maxillary reaches

FIGURE 41—*Cymbacephalus armatus*, new genus, new species. Type

very slightly beyond front eye edge, length  $3\frac{1}{3}$  in head from snout tip; interorbital narrow, depressed. Gill rakers?

Anterosupraorbital spine, followed by row of uniform supraorbital close set denticles of which last 2 posterior enlarged, then pair of frontal spines, pair of parietals and pair of occipitals; 3 postocular spines, 3 above opercle and 2 suprascapulars; pair of strong close set nasal spines, one erect preorbital and suborbital stay with 8 spines, last or preopercular longest, with 2 more on preopercle below; 2 opercular spines.

Scales 46 in lateral line to caudal base and 4 more on latter, unarmed; 5 scales above, 12 below. Very small scales on prepectoral region and breast. Infraorbital and cheek with small close set scales. Opercular scales moderate, smaller posteriorly. Caudal base scaly.

D. VIII—1, 12, 1, third spine  $2\frac{1}{10}$  in total head length, first branched ray  $1\frac{1}{10}$ ; A. 12, 1, third ray  $3\frac{1}{4}$ ; caudal  $1\frac{3}{4}$ , convex behind; least depth of caudal peduncle  $6\frac{1}{4}$ ; pectoral 2, rays 20; ventral  $1\frac{1}{4}$ , rays, 1, 5.

Body brown, paler below. Several dark blotches on body, with large one on back below hind part of spinous dorsal. Three dark blotches below soft dorsal. Spinous dorsal with broad dark oblique band sloping back and joining dark saddle on back. Each ray of soft dorsal with 4 or 5 dark spots. Caudal with 4 or 5 irregular transverse rows of dark spots. Anal pale, with one or two dark spots on each ray terminally. Pectoral with 7 dark cross bars. Ventral with 2 broad dark bands transversely. Several dark spots on lips and others on cheek.

*Type*.—U.S.N.M. no. 98864. (3957.) D. 5148. Siran Island (N.), S.  $80^{\circ}$  W., 3.8 miles (lat.  $5^{\circ}35'40''$  N., long.  $120^{\circ}47'30''$  E.), Sulu Archipelago. In 17 fathoms. February 16, 1908. Length 142 mm.

*Remarks*.—In this species the postocular pit is well developed, the armature of the head strong, the suborbital stay with strong spines, 3 preopercular spines with the upper long, the scales large and the coloration variegated. It differs from *Cymbacephalus nematophthal-* *mus* in the absence of the supraorbital tentacle.

(*armatus*, armed.)

### Family BEMBROPSIDAE

Body long, slender in profile, deepest at front of first dorsal. Tail long, tapering gradually. Head long, broader than deep. Snout long, spatulate. Eye large, conspicuous, mostly before middle in head length. Mouth large, broad, lower jaw protruding. Maxillary small, extends below eye. Gill opening very large, extends forward before eye. Armature of head feeble, with inconspicuous small, slender, sharp spines. Scales large, thin, deciduous, smooth or scarcely rough to touch. Head, excepting muzzle, scaly. Lateral line distinct. Two separate dorsal fins, anterior small, with slender, pungent spines. Anal opposite to and similar to second dorsal. Pectoral long, low. Ventral jugular, inserted close behind preopercle.

One genus. I have admitted this family on its divergence from the other trachinoid families. Its association with the Trachinidae by Alcock in 1899 and later by Jordan, Tanaka, and Snyder in 1913 in the Pteropsaridae is unnatural.

### Genus BEMBROPS Steindachner

Body elongated, broad forward and tail becoming compressed posteriorly. Head large, depressed. Snout broad, concave in profile. Eyes very close together, separated only by narrow bony ridge of

interorbital. Mouth wide, nearly horizontal. Teeth in villiform bands in jaws, on vomer and palatines. Tongue large, spatulate. Opercle with 3 spines. Angle of preopercle with feeble spines. Gill membranes free from isthmus. Gills 4. Pseudobranchiae large. Pyloric caeca 3. Scales cycloid or feebly ctenoid. Lateral line complete, its anterior scales keeled or feebly spinate. Small spine on shoulder girdle. First dorsal short, well separated from second.

**BEMBROPS FILIFER, new species**

FIGURE 42

Depth  $8\frac{1}{2}$ ; head  $2\frac{2}{5}$ , width  $2\frac{2}{3}$ . Snout  $3\frac{1}{4}$  in head from snout tip; eye  $3\frac{7}{8}$ ,  $1\frac{1}{8}$  in snout; maxillary reaches  $\frac{1}{3}$  in eye, ends in pointed fleshy flap behind  $\frac{1}{3}$  of eye, expansion  $3\frac{1}{4}$  in eye, length of bone  $2\frac{7}{8}$  in head from snout tip; villiform bands of teeth in jaws much broader above, 2 vomerine clusters rounded and well separated, and each palatine band long and narrow; nostrils small, well separated, with middle of interval separating them middle of snout length. Gill rakers 6+15, lanceolate, equal gill filaments or  $\frac{1}{3}$  of eye; 3 or 4 of upper and lower gill rakers short rudimentary tubercles. Preopercle with short spine at angle and another similar close above. Of 3 opercular spines uppermost curved upward and lowermost curved down, also most in advance. Small suprascapular spine slightly before uppermost opercular. Opercular flap long, pointed, extends back over front of pectoral.

Scales 50+2 in lateral line, which well decurved over front of anal, ascends posteriorly, though slightly below middle along side of caudal peduncle to caudal base; 3 above at front of spinous dorsal, 6 above at front of soft dorsal, 5 below to front of anal. Scales on breast, belly and under surfaces small. Caudal with nearly basal half scaly. Pectoral base finely scaly. Maxillary scaly. Cheek with 5 or 6 rows of scales, of which uppermost and lowermost much smallest. Lateral line with large, simple tubes, all well exposed. Scales with 27 or 28 basal radiating striae; row of 23 to 25 subequal, short apical denticles; circuli fine, terminate apically at scale edge.

D. VI-I, 13, 1, first spine ending in short filament not quite reaching soft dorsal origin, its length  $2\frac{2}{5}$  in total head length; A. 16, 1, first ray  $6\frac{1}{4}$ , fifteenth ray 5; caudal  $2\frac{1}{4}$ , convex behind; least depth of caudal peduncle  $6\frac{2}{3}$ ; pectoral  $12\frac{2}{3}$ , rays II, 27; ventral rays I, 5, fin  $2\frac{2}{5}$  in total head length.

Brown, little paler below. On back and upper surfaces edges of each scale pocket blackish brown, showing through overlapping scale as dark reticulation. Along side of body, below lateral line row of 8 to 10 obscure rather large brown blotches. Iris grayish. Dorsals and anals with dark or blackish brown membranes, fin rays all more

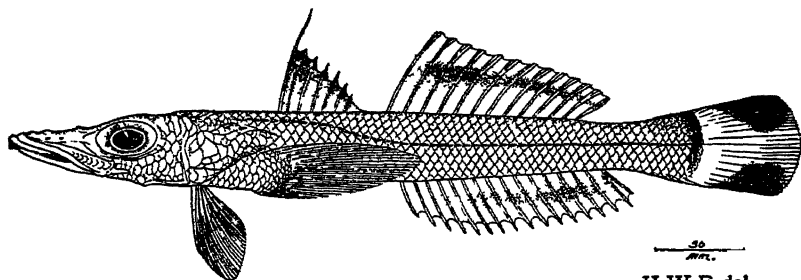
or less paler. Caudal pale or light brown, edges all dark or blackish brown. Paired fins pale brown.

*Type*.—U.S.N.M. no. 98866. D. 5216. Anima Sola Island, N. 44° W., 29.50 miles (lat. 12°52' N., long. 123°23'30'' E.), between Burias and Luzon. In 215 fathoms. April 22, 1908. Length 260 mm.

Also series of 74 other examples here considered as paratypes, from various stations in Philippine Seas, in 9 to 308 fathoms. Length 66 to 249 mm.

*Remarks*.—Apparently related closely to *Bembrops caudimacula* Steindachner, but differing in the long first dorsal spine ending in a filament, thus much longest of all the dorsal spines. Compared with Alcock's figure minor points are the larger eye of *B. filifer*, more posterior insertion of the spinous dorsal, longer pectoral, and notched edge of the anal fin.

(*filifer*, thread bearer, with reference to the first dorsal spine.)



H. W. F. del.

FIGURE 42.—*Bembrops filifer*, new species. Type.

## Family BEMBRIDAE

### PARABEMBRINAE, new subfamily

Type genus, *Parabembras* Bleeker.

Lateral line high, runs along upper side of back. Spinous dorsal larger than second dorsal, which with only 9 rays. Anal like second dorsal.

Includes only *Parabembras*.

### BEMBRINAE, new subfamily

Type genus, *Bembras* Cuvier.

Lateral lines slope from suprascapula, median or axial along side of tail. Base of spinous dorsal always shorter than second dorsal base. Anal long, like second dorsal.

Includes *Brachybembras*, *Bembradium*, *Bembradon*, and *Bembras*.

**BRACHYBEMBRAS, new genus**

*Type*.—*Brachybembras aschemeieri*, new species.

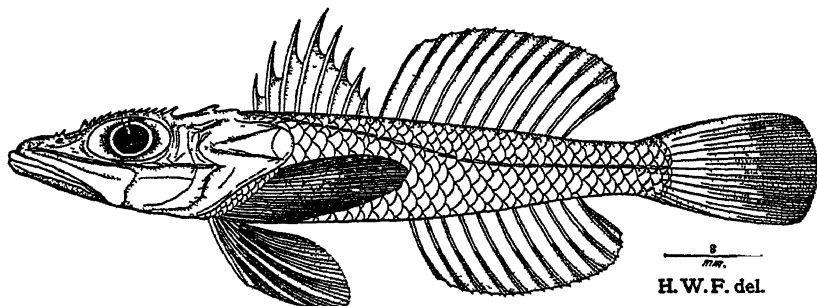
Related to *Bembras*, but differing in its shorter snout, shorter than eye, longer maxillary, and larger scales. Pair of internasal spines. Ventrals close set.

(*βραχύς*, short, with reference to the snout+*Bembras*.)

**BRACHYBEMBRAS ASCHEMEIERI, new species**

FIGURE 43

Depth  $5\frac{3}{4}$ ; head  $2\frac{1}{4}$ , width  $2\frac{2}{5}$ . Snout  $3\frac{2}{5}$  in head; eye 3, little greater than snout, greatly exceeds very narrow interorbital; maxillary reaches  $\frac{2}{5}$  in eye, expansion 2 in eye, length  $2\frac{1}{4}$  in head; teeth minutely villiform, in rather broad bands in jaws, narrower

FIGURE 43.—*Brachybembras aschemeieri*, new genus, new species. Type.

band over vomer and down each palatine; interorbital width 6 in eye, deeply concave. Gill rakers 5+8, though 5 above and below rudiments; gill rakers subequal with gill filaments which 5 in eye.

Two series of spines, with 2 spines in front one and 4 in hind one, between front nostrils; 11 supraorbital spines with first only very slightly enlarged and last followed by another slightly larger parietal spine; 2 more wide set and larger occipital spines; posterior orbital edge finely serrulate, medially with 2 postocular spines; pair of very small, close set backward directed serrae at front ridge of preorbital; keel of suborbital stay entire below first half of eye, then with 5 spines; preopercular spine short, bears large anterobasal spine, and below preopercular edge with 4 small spines, upper of which directed upward; 2 opercular spines, lower little in advance; suprascapular spine strong; short humeral spine.

Scales (pockets) 30+2 in lateral line; 3 above, 6 below; 5 predorsal forward to occiput; 3 below suborbital stay on cheek. Head scaly behind and below eyes. Scales smaller on breast and belly than on

sides of body. Small scales on caudal and pectoral bases. Lateral line rather high at first, with 4 or 5 scales each bearing a firm bony keel ending in small spine behind; course slopes gradually down until median along side of caudal peduncle. Scales with 9 basal radiating striae; 23 to 25 short uniserial apical denticles; circuli rather fine, coarse apically, where ending abruptly.

D. VIII-12, 1, fourth spine  $2\frac{1}{2}$  in head, third ray  $2\frac{2}{5}$ ; A. 11, 1, fifth ray  $3\frac{1}{8}$ ; caudal  $1\frac{3}{4}$ , subtruncate, or slightly convex behind; least depth of caudal peduncle  $6\frac{1}{4}$ ; pectoral  $2\frac{1}{4}$ , rays 21; ventral rays I, 5, fin 2 in head.

Body pale brown. Head pale, nearly whitish on snout. Iris gray, with silvery white tinge. Fins all more or less grayish, many rays with more less whitish.

*Type*.—U.S.N.M. no. 98881. (9652.) D. 5172. Jolo Light, E. 24.75 miles (lat.  $6^{\circ}3'15''$  N., long.  $120^{\circ}35'30''$  E.), vicinity of Jolo. In 318 fathoms. March 5, 1908. Length 67 mm.

(Named for C. R. Aschemeier, taxidermist of the U. S. National Museum, who has secured many fishes for the collections.)

## Family OPLICHTHYIDAE

### ANALYSIS OF GENERA

- $\alpha^1$ . Areas before and below eyes moderate, so preorbital extent equals eye.
  - $\delta^1$ . Scutes of lateral line each with 2 well developed spines which subequal or upper little larger..... **Oplichthys**
  - $\delta^2$ . Scutes of lateral line each with large single strong spine, directed up and back, so only single row of spines formed along each side of back; sometimes auxiliary small spine in interspaces between scutes and in line with larger spines... **Monhoplichthys**
  - $\delta^3$ . Scales of lateral line each with large, erect, strong spine, besides an inner smaller superior spine, these forming 2 series of lateral spines, of which upper smaller and less conspicuous..... **Pristhoplichthys**
- $\alpha^2$ . Areas before and below eyes large, smooth and elongate, 1 to  $1\frac{1}{4}$  times eye diameter..... **Rhinhoplichthys**

### MONHOPLICHTHYS, new genus

*Type*.—*Monhoplichthys gregoryi*, new species.

Scutes of lateral line each with large single strong spine, directed up and back, so only single row of spines formed along each side of back. Sometimes auxiliary small spine in interspaces between scutes and in line with larger spines.

(*μόνος*, one + *Hoplichthys*; with reference to the armature.)

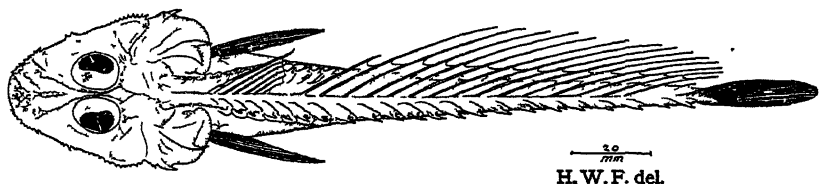


## MONHOPLICHTHYS GREGORYI, new species

FIGURE 44

Depth  $11\frac{4}{5}$  to  $12\frac{3}{4}$ ; head  $3\frac{1}{8}$  to  $3\frac{1}{5}$ , width  $1\frac{1}{3}$  to  $1\frac{1}{2}$ . Snout  $3\frac{1}{10}$  to  $3\frac{1}{2}$  in head; eye  $3\frac{7}{8}$  to 4,  $1\frac{1}{8}$  to  $1\frac{1}{6}$  in snout; maxillary extends below first  $\frac{1}{8}$  in eye, length  $2\frac{1}{8}$  to  $2\frac{1}{2}$  in head; teeth minutely villiform, in bands in jaws, continuous band across vomer and band on each palatine; interorbital very narrow, width 6 in eye, deeply concave. Gill rakers 2+12, rather short, firm, lanceolate, equal gill filaments or  $\frac{1}{5}$  or eye.

Bones of head all finely or minutely serrate or striate, and on top of head pair of rather wide set spines serrate represent parietal at upper hind orbital edge and strong short occipital pair, though both pairs small. Serrae of lateral ridge or suborbital stay all small, rather numerous, and 4 enlarged spines moderate, with first directed for-

FIGURE 44.—*Monhoplichthys gregoryi*, new genus, new species. Type.

ward. Preopercular spine with anterior outer ridge bearing 8 or 9 graduated serrae up to large anterobasal spine; preopercular spine  $1\frac{1}{10}$  to  $1\frac{1}{4}$  in eye. Opercular spines rather slender, ends opposite. Strong keeled humeral spine. Lateral line with 28 to 29 spines, larger and stronger posteriorly.

D. VI-15, 1, first spine  $2\frac{1}{8}$  to 3 in head, first ray  $2\frac{1}{5}$  to  $3\frac{1}{8}$  and sixth to eighth prolonged or filiform, or nearly long as head; A. 17, 1, seventh ray  $3\frac{1}{2}$  to  $3\frac{3}{4}$ , edge of membrane notched after tip of each; caudal  $1\frac{1}{2}$  to 2, median rays longest, lower rays slightly longer, and hind edge of fin little oblique; least depth of caudal peduncle  $3\frac{3}{4}$  to  $3\frac{5}{8}$  in eye; pectoral reaches third anal ray or  $1\frac{1}{10}$  to 2 in head, rays 12, III, or 13, III, lowest ones detached, free, and  $1\frac{1}{8}$  to  $1\frac{1}{6}$  in fin; ventral rays I, 4, fin  $2\frac{3}{5}$  to  $2\frac{3}{4}$  in head.

Pale or light brown, apparently largely whitish below. Iris light gray. Fins uniformly pale, nearly white. Spinous dorsal with membranes dark brown.

*Type*.—U.S.N.M. no. 98862. D. 5519. Point Tagolo Light, S.  $71^{\circ}$  W., 8.7 miles (lat.  $8^{\circ}47'$  N., long.  $123^{\circ}31'15''$  E.), vicinity of northern Mindanao. In 182 fathoms. August 9, 1909. Length 202 mm.

*Remarks.*—Besides the above are 6 paratypes, same data, 86 to 210 mm long. Apparently most closely related to *Hoplichthys acanthopleurus* Regan from Saya de Malha Ban, Indian Ocean. That species would differ in its lower spinous dorsal, "scarcely higher in the male than in the female", and shown in the original figure of the male as  $3\frac{1}{4}$  for first spine in the head, in the male most all the dorsal rays ending in long filaments and the 3 detached pectoral filaments  $1\frac{3}{4}$  in the fin.

(Named for Dr. William K. Gregory, of the American Museum of Natural History.)

**MONHOPLICHTHYS PROSEMION, new species**

FIGURE 45

Depth  $12\frac{1}{2}$ ; head  $3\frac{1}{3}$ , width  $1\frac{1}{4}$ . Snout  $3\frac{1}{3}$  in head; eye  $3\frac{2}{3}$ ,  $1\frac{1}{8}$  in snout; maxillary reaches first  $\frac{1}{8}$  in eye, length  $2\frac{4}{5}$  in head; teeth minutely villiform, in bands in jaws, band over vomer and narrow

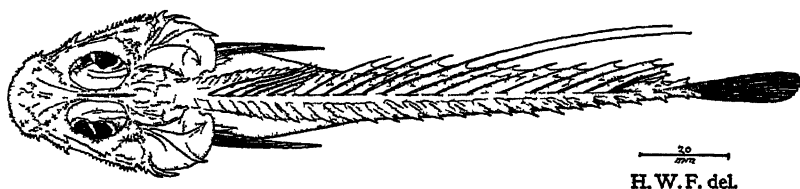


FIGURE 45.—*Monhoplichthys prosemion*, new genus, new species. Type.

one on each palatine; interorbital narrow, concave, width 6 in eye. Gill rakers  $2+12$ , low, short, robust,  $\frac{3}{4}$  of gill filaments, which 5 in eye.

Bones of head all finely or minutely serrate or striate, and on top of head pair of rather wide set spines represent parietal at upper hind orbital edge, and moderately large, strong, occipital pair, erect and directed back. Serrae of lateral ridge or suborbital stay well developed rather long, prominent, anterior flare forward, and only 2 others anteriorly little enlarged. Preopercular spine with anterior outer ridge bearing 5 spines, graduated to large antero-basal spine, which well curved upward; preopercular spine equals eye. Opercular spines well curved, upper little in advance. Strong, keeled, erect humeral spine. Lateral line with  $28+1$  spines, larger and stronger posteriorly.

D. VI—15, 1, end of spinous fin reaching base of second dorsal ray, first spine 2 in head, fifth to eighth rays greatly prolonged in filaments  $1\frac{1}{4}$  times head; A. 17, 1, seventh ray  $3\frac{2}{3}$  in head, edge of membrane notched after tip of each; caudal  $1\frac{7}{8}$ , slightly convex be-

hind; least depth of caudal peduncle  $3\frac{1}{3}$  in eye; pectoral  $1\frac{7}{8}$  in head, rays 13, III, lowest ones detached and slightly longer than fin; ventral rays I, 4, fin  $2\frac{1}{8}$  in head.

Back and head above brown, latter paler marginally. Iris gray, Under surfaces whitish. Fins pale, pectoral and caudal terminally with brownish. Ventrals and anal whitish.

*Type*.—U.S.N.M. no. 98863. D. 5117. Sombrero Island, S.  $17^{\circ}$  E., 10.80 miles (lat.  $13^{\circ}52'22''$  N., long.  $120^{\circ}46'22''$  E.), Balayan Bay and Verde Island Passage. In 118 fathoms. January 21, 1908. Length 173 mm.

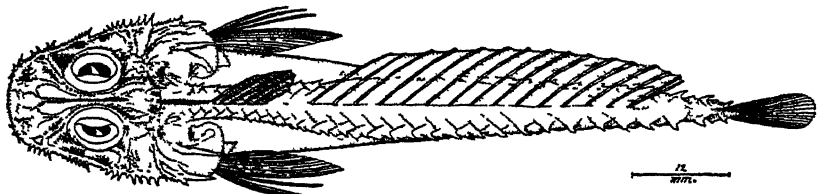
*Remarks*.—Differs from *Monhoplichthys gregoryi* in the long spinous dorsal, larger eyes, more conspicuous armature of the head, and filiform dorsal rays.

(*πρό*, forward + *σημεῖον*, banner; with reference to the dorsal fin.)

MONHOPLICHTHYS SMITHI, new species

FIGURE 46

Depth  $12\frac{1}{4}$ ; head  $3\frac{2}{5}$ , width  $1\frac{1}{2}$ . Snout  $3\frac{1}{2}$  in head; eye 4,  $1\frac{1}{10}$  in snout; maxillary reaches first  $\frac{1}{8}$  in eye, length 3 in head; teeth



H. W. F. del.

FIGURE 46.—*Monhoplichthys smithi*, new genus, new species. Type.

minutely villiform, in narrow bands in jaws, band narrowly over vomer and similar one on palatine; interorbital narrow, concave, width 4 in eye. Gill rakers 2+9, short, robust points, little less than gill filaments, which 5 in eye.

Bones of head moderately rugose striate or minutely serrate, and on top of head pair of moderately spaced small parietal spines, and posteriorly pair of occipital spines equidistant. Spines of lateral ridge or suborbital stay all rather large, well developed, anterior flare forward, likewise some below eye. Preopercular spine with anterior outer ridge bearing 4 spines, graduated to large anterobasal spine, which only slightly slopes upward; preopercular spine equals eye. Opercular spines curved, ends opposite. Strong, keeled, erect humeral spine. Lateral line with 28 spines, larger and stronger posteriorly.

D. VI—15, 1, end of depressed spinous fin reaches  $\frac{3}{4}$  to origin of soft dorsal, first spine  $3\frac{1}{4}$  in head, third ray  $2\frac{1}{3}$ ; A. 17, 1, seventh ray  $2\frac{3}{5}$ ; least depth of caudal peduncle 3 in eye; caudal 2 in head, apparently convex behind; pectoral  $1\frac{1}{2}$  in head, rays 12, III, lowest ones detached and  $1\frac{1}{5}$  times fin; ventral rays I, 4, fin 2 in head.

Brown above, pale to whitish below. Eye gray. First dorsal dark brown. Second dorsal with several brownish spots on each ray. Caudal with 4 or 5 indistinct dark transverse bars. Pectoral brownish, with obscure small dark variable spots, lower 3 rays whitish. Ventrals and anal whitish.

*Type*.—U.S.N.M. no. 59588. Kagoshima, Japan. Dr. H. M. Smith. 1903. Length 99 mm.

*Remarks*.—Differs from *Monhoplichthys gilberti* (Jordan and Richardson), also from Japan, in the longer maxillary reaching below the front of the eye, conspicuous armature of the head, and long detached pectoral rays.

(Named for Dr. Hugh M. Smith.)

#### PRISTHOPLICHTHYS, new genus

*Type*.—*Hoplichthys platophrys* Gilbert.

Scutes of lateral line each bearing large, erect, strong spine, besides an inner smaller superior spine, thus forming 2 series of lateral spines of which the upper is smaller and less conspicuous. Interorbital broad as eye. Armature of head moderate.

One species: *Pristhoplichthys platophrys*, of Hawaiian seas.

(*πρίστης*, one who saws + *Hoplichthys*, with reference to the armature.)

#### PRISTHOPLICHTHYS PLATOPHRYS (Gilbert)

*Hoplichthys platophrys* GILBERT, Bull. U. S. Fish Comm., vol. 23, pt. 1, p. 642, fig. 250, 1903 (1905) (type locality, Laysan Island, in 351 fathoms).—FOWLER, Mem. Bishop Mus., vol. 10, p. 300, 1928 (copied).

Depth 10; head  $2\frac{3}{4}$ , width  $1\frac{1}{5}$ . Snout 3 in head; eye  $4\frac{1}{3}$ ,  $1\frac{1}{2}$  in snout, little greater than interorbital; maxillary reaches opposite front eye edge; teeth very minute, villiform, in narrow bands in jaws, on vomer and palatines; interorbital width 5, concave. Gill rakers 2+7?, short, less than gill filaments, which 3 in eye.

Bones of head with minute denticles or serrae, and on top of head pair of moderately wide set parietals, with a postocular spine on each suprapostocular ridge, and pair of moderately close set occipitals. Serrae of lateral ridge or suborbital stay all moderate, distinct, 3 anterior each side directed forward and inward and one each side opposite hind nostrils slightly larger and directed outward. Preopercular outer ridge bears 3 or 4 spines graduated to larger antero-

basal spine, which flares out and back; preopercular spine  $3\frac{4}{5}$  in head. Opercular spines little curved, lower slightly shorter or in advance. Strong sharp humeral spine. Lateral line with 27 spines, all erect and larger and stronger posteriorly.

D. VI-15, 1, first spine long as eye, first ray 4 in head, fifth ray  $2\frac{2}{3}$ ; A. 18, 1, fin height  $3\frac{2}{3}$ ; caudal  $2\frac{1}{2}$ , little convex behind; least depth of caudal peduncle 2 in eye; pectoral  $1\frac{1}{3}$  in head, rays 13, III, lower detached rays with basal webs so about half adnate, length half of fin; ventral rays I, 5, fin  $2\frac{1}{3}$  in head.

Brown, paler below. Above 4 brownish transverse blotches, now 3 most distinct on flanks and tail. Iris gray. Spinous dorsal blackish terminally. Each ray of soft dorsal with several dark spots. Anal whitish, tinted with brownish on rays. Caudal whitish, little dark basally, gray terminally. Pectoral with some brownish, other fins whitish.

*Type*.—U.S.N.M. no. 51620. (3952.) Near Laysan Island. In 347 to 351 fathoms. May 21, 1902. Length 70 mm.

Known only from the type, described above.

#### RHINHOPLICHTHYS, new genus

*Type*.—*Hoplichthys haswelli* McCulloch.

Distinguished from *Oplichthys* by the very large smooth and elongated areas before and below the eyes, so the preorbital extent of this area at least 1 to  $1\frac{1}{4}$  times the eye diameter. Snout elongated and spatulate. Interorbital moderate. Vomer with a large patch of enlarged, simple, pointed teeth, giving off two long, pointed extensions behind.

( $\rho$ lv, snout + *Hoplichthys*.)

#### Family TRIGLIDAE

##### ANALYSIS OF GENERA

- a<sup>1</sup>. TRIGLINAE. Row of spine bearing bony bucklers along bases of both dorsal fins. (Type genus, *Trigla* Linnaeus.)
- b<sup>1</sup>. Scales larger, 50 to 60 in lateral line.
  - c<sup>1</sup>. Lateral line armed with spiny plates..... Paratrigla
  - c<sup>2</sup>. Lateral line unarmed.
    - d<sup>1</sup>. Erect spiny bucklers along bases of both dorsals..... Lepidotrigla
    - d<sup>2</sup>. Flattened spiny bucklers along spinous dorsal base, erect along soft dorsal base..... Pachytrigla
- b<sup>2</sup>. Scales smaller, 100 or more in lateral line.
  - e<sup>1</sup>. Head usually with small spines; scapular spine moderate..... Trigla
  - e<sup>2</sup>. Head nearly smooth, spineless; scapular spine short.... Currupiscis

- a<sup>2</sup>. PTERYGOTRIGLINÆ.** Large bucklers only along spinous dorsal base or absent. (Type genus, *Pterygotrigla* Waite.)
- f.** Few bony bucklers only along spinous dorsal base.
- g<sup>1</sup>.** Upper opercular spine short, reaches pectoral origin; humeral spine elongate.
- h<sup>1</sup>.** Scapular spine very short; rostral spines short; no postero-supraorbital spine----- *Pterygotrigla*
- h<sup>2</sup>.** Scapular spine long and strong; rostral spines long.
- i<sup>1</sup>.** Snout shorter, length 2 or more in head.
- j<sup>1</sup>.** Maxillary reaches  $\frac{3}{4}$  to eye; rostral spines long as eye----- *Bovitrigla*
- j<sup>2</sup>.** Maxillary reaches eye; rostral spine  $\frac{2}{3}$  rest of head----- *Dixiphistops*
- k<sup>1</sup>.** Snout long,  $1\frac{1}{4}$  in head; maxillary not reaching eye; rostral spine  $\frac{2}{3}$  rest of head----- *Dixiphistes*
- g<sup>2</sup>.** Upper opercular spine enlarged, long, reaches  $\frac{1}{2}$  in pectoral; humeral spine short----- *Otothime*
- f<sup>2</sup>.** No bony plates or bucklers along dorsal base----- *Dixiphichthys*

### Genus LEPIDOTRIGLA Günther

#### Subgenus LEPIDOTRIGLA Günther

Each bony buckler, along each side of the bases of the dorsal fins, with a large, simple, entire spine.

Of the typical species *Lepidotrigla cavillone* (Lacépède) I have examined two specimens: U.S.N.M. no. 2219, Europe; C. L. Bonaparte Collection, Acad. Nat. Sci. Philadelphia. Length 85 to 110 mm, caudal fins broken.

#### LEPIDOTRIGLA OGLINA, new species

##### FIGURE 47

Depth  $3\frac{1}{2}$  in body from snout tip; head 3, width  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head; eye 3,  $1\frac{1}{5}$  in snout, greater than interorbital; preorbital depth below front eye edge  $1\frac{3}{4}$  in eye; maxillary reaches  $\frac{1}{5}$  in eye, length  $2\frac{4}{5}$  in head; teeth minutely villiform, in rather broad bands in jaws, none on palate; interorbital 4, deeply concave. Gill rakers 0+10, short,  $4\frac{1}{2}$  in eye, subequal with gill filaments.

Pair of short, broad, rostral spines, edge of each inside with several denticles; supraorbital ridge finely serrated, with 2 low anterior denticles, and larger posterior strong spine, followed by short notch; suprascapular spine short, sharp pointed; postocular ridge serrated, ends in short spine; no keel to suborbital stay, and preopercle without spines; opercle with pointed spine, level with lower edge of eye; humeral spine long, slender, equals eye, base broad.

Scales 52 in lateral line to caudal base, tubes small and simple; 3 scales above lateral line opposite soft dorsal origin, 13 below, 7 predorsal. Chest, breast, prepectoral, and region narrowly behind paired fins naked. Caudal largely covered with small scales, more numerous basally. Along dorsal bases 22 bony plates, each with strong spine, and 8 along first dorsal. Scales of lateral line not enlarged, though rather narrowly imbricated. Scales with 5 or 6 basal radiating striae; 18 to 20 short, broad apical spines; circuli fine, obsolete or end abruptly apically.

D. IX-14, first spine with front edge serrated, second spine  $1\frac{3}{5}$  in head, third ray  $2\frac{7}{8}$ ; A. 15, 1, fourth ray  $3\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ , little concave behind; least depth of caudal peduncle  $2\frac{1}{4}$  in eye; pectoral reaches  $2\frac{1}{5}$  to caudal base, uppermost of 3 lower detached rays  $1\frac{1}{5}$  in

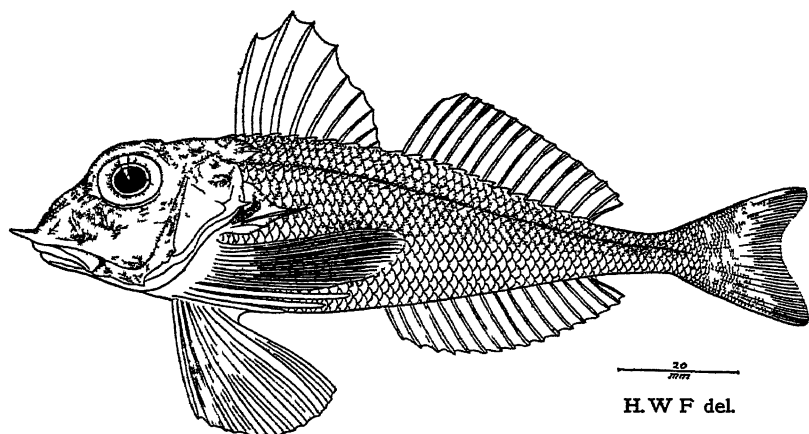


FIGURE 47.—*Lepidotrigla oolina*, new species Type.

upper section of fin, rays 1, 7, III-III, upper section of fin reaches base of third anal ray, length  $1\frac{1}{5}$  in head; ventral  $1\frac{1}{8}$ , rays I, 5, fin reaches little beyond base of fourth anal ray.

Head pale brown. Iris pale, evidently white. Body with upper  $\frac{3}{5}$  brown and remaining lower portion white, line of demarcation pronounced. Upper section of pectoral largely gray black, white all around, and outer face of each ray narrowly whitish. Fins otherwise pale or whitish. Under surface of body with more or less silvery white reflections.

*Type*.—U.S.N.M. no. 98865. (1349.) D. 5315. Lat.  $21^{\circ}40'$  N., long.  $116^{\circ}58'$  E., China Sea in vicinity of Formosa. In 148 fathoms. November 5, 1908. Length 129 mm.

Only the type known. This differs from all other species in its very large eye, exceeding the depth of the preorbital.

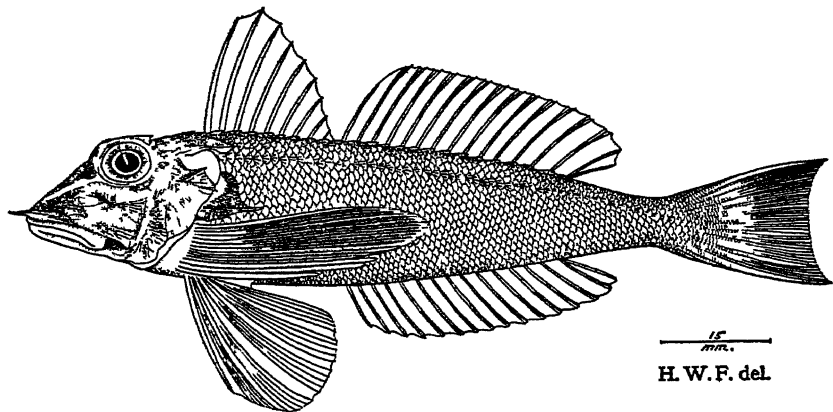
(*ogle*, with reference to the large eyes.)

## LEPIDOTRIGLA VENUSTA, new species

FIGURE 48

Depth  $4\frac{1}{3}$  to  $4\frac{2}{3}$  measured from snout tip; head 3 to  $3\frac{1}{4}$ , width  $1\frac{2}{3}$  to 2. Snout  $2\frac{2}{5}$  to  $2\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{3}$  to  $3\frac{2}{5}$ ,  $1\frac{1}{3}$  to  $1\frac{2}{5}$  in snout, 2 to 3 times interorbital width; maxillary reaches below front edge of eye, length  $2\frac{1}{3}$  to  $2\frac{3}{4}$  in head from snout tip; mouth width  $2\frac{3}{4}$  to  $3\frac{1}{8}$ ; narrow bands of minute villiform teeth in jaws, none on palate; interorbital 7 to 9, deeply concave. Gill rakers 0+7, lanceolate,  $1\frac{1}{4}$  in gill filaments or 4 in eye.

Pair of short, triangular, broad, flat, rostral spines, more or less flaring out, and edges entire; 2 antero-supraorbital spines each side and 2 postero-supraorbitals each side, close and with rather deep transverse groove close behind; ridge of suborbital stay obsolete or not developed and no spine at preopercle angle; strong, pointed

FIGURE 48.—*Lepidotrigla venusta*, new species. Type.

suprascapular spine; small, pointed opercular spine, level with lower edge of eye; strong pointed humeral spine with broad, deep base, longer than spine.

Scales 52 to 54 in lateral line to caudal base and 2 or 3 more on latter; 4 above, 18 below; 4 or 5 predorsal. Chest, breast, belly, and caudal base finely scaled, only small area behind paired fins and prepectoral region naked. Along each side of bases of dorsals 23 bucklers, each bearing a strong spine. Lateral line little high, distinct, each scale usually with trifid tubes. Scales with 5 to 13 basal radiating striae; 0 to 6 short apical points; circuli fine, concentric.

D. IX-15, 1, first spine  $1\frac{3}{7}$  to  $1\frac{3}{5}$  in head, third ray 2 to  $2\frac{1}{8}$ ; A. 15, 1, third ray  $2\frac{2}{3}$  to 3; caudal  $1\frac{1}{3}$  to  $1\frac{1}{4}$ , little emarginate behind; least depth of caudal peduncle  $1\frac{2}{5}$  to  $1\frac{1}{2}$  in eye; pectoral  $2\frac{1}{2}$  to  $2\frac{5}{8}$  in length from snout tip to caudal base, reaches  $1\frac{3}{4}$  to 2 to caudal base,



rays I, 6, IV-III, uppermost ray of lower section  $1\frac{1}{8}$  to  $1\frac{1}{5}$  in upper section of fin; ventral reaches second anal ray, fin  $1\frac{1}{8}$  to  $1\frac{1}{5}$  in head, rays I, 5.

Head brownish, whitish on sides and below with silvery reflections. Upper half of body pale brownish, lower half of sides silvery white. Pectoral with upper section marked with a large uniform blackish brown blotch, leaving entire fin border white. Fins otherwise all pale to whitish.

*Type*.—U.S.N.M. no. 98872. (24328.) D. 5442. San Fernando Point Light, N.  $39^{\circ}$  E., 8.4 miles (lat.  $16^{\circ}30'36''$  N., long.  $120^{\circ}11'06''$  E.), west coast of Luzon. In 45 fathoms. May 10, 1909. Length 111 mm. Also a series of Philippine paratypes.

*Remarks*.—This species appears to be related to *Lepidotrigla spiloptera* Günther, though that species with a broader interorbital, shorter pectoral, truncate caudal, and ventrals only reaching anal. Günther's description does not mention scales on the breast and his figure fails to reveal any. The species is best characterized by its entirely scaled breast, chest, and belly, only the prepectoral region and narrow postbasal space of the paired fins naked.

(*venusta*, beautiful.)

LEPIDOTRIGLA PECTORALIS, new species

FIGURE 49

Depth  $4\frac{1}{4}$ ; head  $2\frac{3}{4}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{1}{10}$  in head; eye  $4\frac{2}{5}$ , 2 in snout, subequal with interorbital; maxillary reaches eye, length  $2\frac{1}{8}$  in head; mouth width  $2\frac{1}{2}$ ; teeth rather coarsely villiform, in moderately broad bands in jaws, none on palate; interorbital  $4\frac{2}{5}$  in head, low, broadly depressed concavely. Gill rakers 0+8, of which 3 lowest mere rudimentary tubercles; short, strong, lanceolate,  $\frac{3}{5}$  of gill filaments, which  $2\frac{1}{4}$  in eye.

Head largely unarmed or few spines developed very short, small or inconspicuous; bones of head with distinct, radiating, rugose striate surfaces; preocular groove narrow, forward to nostrils; notch above upper hind edge of eye on each side of head; ridge of suborbital stay little distinct and without any armature, and no spine on preopercle; opercle ends in rather broad point behind; as viewed above upper front edge of head blunt with row of small marginal denticles; long strong humeral spine, 3 in head.

Scales 53+4 in lateral line, enlarged and tubes simple; 6 above opposite soft dorsal origin, 20 below to anal origin; 10 predorsal. Small and minutely ctenoid scales on predorsal, trunk and tail and extended over caudal basally. Breast, chest, prepectoral, belly, and region from basal part of humeral spine to vent naked. Along dor-

sal bases 27 spinous bucklers, of which 10 along spinous dorsal base. Scales with 8 to 10 rather large, parallel erect denticles on apical half; circuli fine, even.

D. IX-18, third spine  $2\frac{1}{2}$  in head, third ray  $2\frac{1}{2}$ ; A. 17, eighth ray 3; caudal  $1\frac{3}{5}$ , slightly concave behind; least depth of caudal peduncle  $1\frac{3}{5}$  in eye; pectoral reaches  $1\frac{1}{4}$  to caudal,  $1\frac{4}{5}$  in fish without caudal; pectoral rays II. 5, IV-III, uppermost of 3 lower detached rays  $2\frac{1}{8}$  in upper section of pectoral; ventral  $1\frac{1}{4}$  in head, reaches front of anal.

Light brown, under surface of head and belly whitish. Iris pale to whitish. Spinous dorsal pale with gray black blotch broadly terminal on fourth to eighth membranes. Pectoral with upper half of upper section gray black. Fins otherwise all pale or whitish.

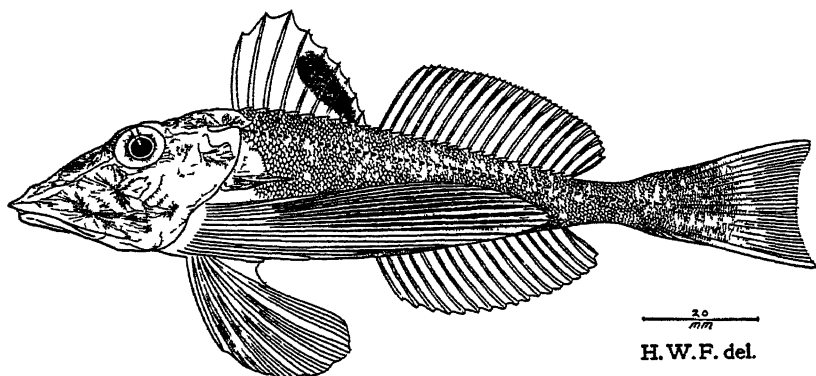


FIGURE 49—*Lepidotrigla pectoralis*, new species Type.

*Type*.—U.S.N.M. no. 98878. (4256.) D. 5517. Point Tagolo Light, S.  $83^{\circ}$  W., 10.5 miles (lat.  $8^{\circ}45'30''$  N., long.  $123^{\circ}33'45''$  E.), vicinity of northern Mindanao. In 169 fathoms. August 9, 1909. Length 140 mm.

*Remarks*.—Suggestive of *Lepidotrigla japonica* (Bleeker) but that species with greatly larger scales, different physiognomy, much shorter scaly predorsal and larger suprascapular spine, also without the large black blotch on the spinous dorsal.

(*pectoralis*, pectoral, with reference to its long pectorals.)

**LEPIDOTRIGLA ARGYROSOMA, new species**

FIGURE 50

Depth  $4\frac{2}{3}$  (in length measured from snout tip): head  $3\frac{1}{6}$ , width  $1\frac{4}{5}$ . Snout  $2\frac{1}{4}$  in head: eye  $3\frac{1}{2}$ ,  $1\frac{1}{2}$  in snout, greatly exceeds interorbital; maxillary reaches opposite front eye edge, length  $2\frac{1}{2}$  in head; teeth minute, villiform, in narrow bands in jaws, none on pal-

ate; interorbital 8, deeply concave. Gill rakers 1+10, of which 4 lowest mere short low rudiments; lanceolate,  $2\frac{1}{2}$  in eye, longer than gill filaments.

Pair of broad, flat, triangular, divergent, rostral spines, extended forward, half of eye; 2 antero-supraorbital spines each side and postero-supraorbital spines each side, close and with rather deep transverse groove close behind; ridge of suborbital stay obsolete, little developed, and with only very short, small spine at preopercle angle; strong, pointed, suprascapular spine; smaller, pointed opercular spine, level with lower edge of eye; strong pointed humeral spine, with broad deep base, subequal with length of spine.

Scales 53 or 54 in lateral line to caudal base and 2 or 3 more on latter; 4 above, 19 or 20 below; 5 predorsal. Chest, breast, belly,

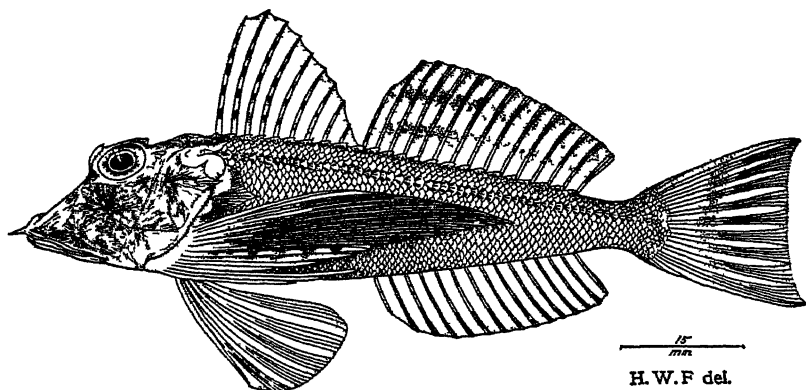


FIGURE 50—*Lepidotrigla argyrosoma*, new species. Type

and caudal base finely scaled, only prepectoral region and small area behind bases of paired fins naked. Along each side of bases of dorsals 23 bucklers each bearing a strong spine. Lateral line little high, distinct, each scale with trifid tubes. Scales with 4 to 6 basal radiating striae; 0 to 8 short strong apical points; circuli fine, concentric, often obsolete apically.

D. IX-15, first spine  $1\frac{3}{4}$  in head, third ray 2; A. 15, seventh ray  $2\frac{4}{5}$ ; caudal  $1\frac{1}{3}$ , emarginate behind; least depth of caudal peduncle  $1\frac{1}{3}$  in eye; pectoral reaches  $1\frac{1}{2}$  to caudal base,  $2\frac{1}{3}$  in length from snout tip to caudal base, reaches eleventh anal ray base, rays I, 5. IV-III, uppermost ray of lower section  $1\frac{3}{5}$  in upper section of fin; ventral reaches fourth anal ray base, fin  $1\frac{1}{10}$  in head, rays I, 5.

Head brownish, with silvery reflection and pale lilac tints on sides and below eye. Upper half of body pale fawn brown, lower half white with silvery tints. Dorsal spines each with 4 or 5 dull brown blotches. Second dorsal with 2 rows of brownish spots, 2 spots on

each membrane. Upper section of pectoral with large gray black blotch, border all around whitish, also each ray on outer face narrowly whitish. Ventral pale yellowish brown, edge all around white. Fins otherwise whitish.

*Type*.—U.S.N.M. no. 98873. (24363.) D. 5442. San Fernando Point Light, N.  $39^{\circ}$  E., 8.4 miles (lat.  $16^{\circ}30'36''$  N., long.  $120^{\circ}11'06''$  E.), west coast of Luzon. In 45 fathoms. May 10, 1909. Length 94 mm.

Also a series of Philippine paratypes.

*Remarks*.—Apparently this is close to, if not synonymous with, *Lepidotrigla spiloptera* var. *longipinnis* Alcock. According to Alcock it "only differs from the type in the great length of the pectoral fins, which reach to, or beyond, the 9th anal ray." As this name was proposed by Alcock in 1890 it is precluded by *Lepidotrigla longipinnis* Steindachner and Döderlein, 1887.

(ἀργύρος, silver + σῶμα, body.)

#### PRISTHOPLOTRIGLA, new subgenus

*Type*.—*Lepidotrigla strauchi* Steindachner.

Characterized by the spinous bucklers, in a row each side of the base of the first dorsal fin, with a serrated edge. This is also visible in a lateral view but not shown on published figures.

(πίστις, saw + ὅπλον, armor + *Trigla*.)

#### STAGONOTRIGLA, new subgenus

*Type*.—*Lepidotrigla macrobrachium*, new species.

This group is defined chiefly by the spotted dark area of the pectoral fins, as seen from the inside. The pectoral is variable in length, from short to long.

(σταγών, spot + *Trigla*.)

#### LEPIDOTRIGLA PUNCTIPECTORALIS, new species

#### FIGURE 51

Depth  $4\frac{1}{2}$  in length measured from snout tip; head  $3\frac{1}{10}$ , width  $1\frac{1}{2}$ . Snout  $2\frac{1}{6}$  in head from snout tip; eye  $3\frac{7}{8}$ ,  $1\frac{4}{5}$  in snout, slightly greater than interorbital; maxillary reaches  $\frac{7}{8}$  to eye, length 3 in head from snout tip; mouth width  $2\frac{1}{2}$ ; teeth minutely villiform, in bands in jaws, upper band broadly exposed when mouth closes; interorbital  $5\frac{1}{3}$  in head from snout tip, deeply concave. Gill rakers 1+13, of which lowest 6 mere rudiments; longest  $\frac{3}{4}$  of gill filaments, which  $2\frac{1}{2}$  in eye.

Pair of broadly flattened, triangular rostral spines, about  $2\frac{1}{2}$  in eye, edges of each entire; 2 low, short, antero-supraorbital spines

each side, followed by close set, low, broad pair above hind eye edge, behind which a deep notch; pair of low, small occipital spines; suprascapula with broad plate bearing strong spine with keel forward; strong horizontal postocular keel bearing several close set points behind; ridge of suborbital stay little developed, only below eye, ends in blunt spine at preopercle angle; small opercular spine, level with lower edge of eye, extends back little over gill opening; large, broad humeral plate with horizontal keel ending in strong, slender spine, slightly longer than eye.

Scales 58 in lateral line to caudal base, each with 5 or 6 divergent tubules; 4 above to soft dorsal origin, 16 below; 7 predorsal. Chest, breast, prepectoral region and basal region close behind paired fins naked. Small scales on belly and caudal base. Along bases of dorsals

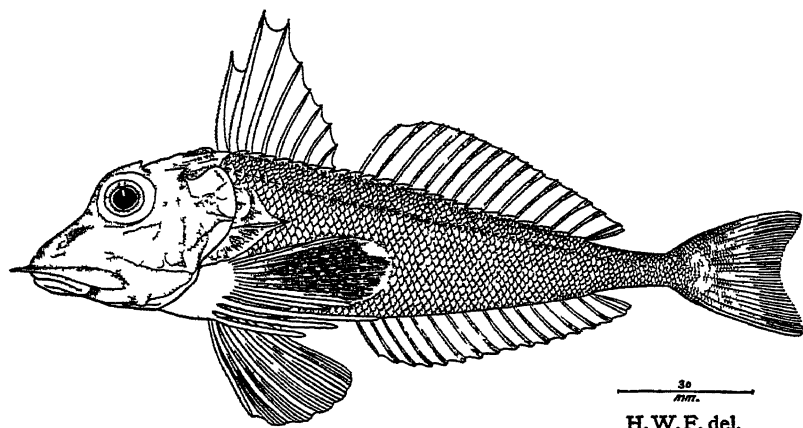


FIGURE 51.—*Lepidotrigla punctipectoralis*, new species. Type.

each side 23 bony bucklers, each armed with a strong spine, of which 8 along base of spinous fin. Scales with 4 to 6 basal radiating striae; row of 13 to 15 rather triangular apical denticles; circuli fine, obsolete apically.

D. X-15, 1, second spine  $1\frac{1}{2}$  in head from snout tip, fifth ray 3; A. 16, fifth ray 4; caudal  $1\frac{1}{2}$ , slightly emarginate behind; least depth of caudal peduncle  $1\frac{3}{4}$  in eye; pectoral  $1\frac{1}{3}$ , rays I, 7, III-III, uppermost of 3 lower detached rays equals pectoral, though as little advanced not reaching hind end of pectoral; ventral reaching base of second anal ray, rays I, 5, fin  $1\frac{1}{4}$  in head from snout tip.

Head brownish. Iris gray, apparently white in life. Upper half of body pale yellowish brown, lower half silvery white. Fins whitish. Upper part of pectoral largely gray black. all rays on outer surfaces whitish; in blackish area scattered small white spots and several larger below; edge of fin white all around.

*Type*.—U.S.N.M. no. 98871. (1562.) D. 5135. Jolo Light, S. 46° W., 11.90 miles (lat. 6°11'50" N., long. 121°8'20" E.), vicinity of Jolo. In 161 fathoms. February 7, 1908. Length 175 mm.

*Remarks*.—Very close to *Lepidotrigla kishinouyei* Snyder, which also has the dark area of the pectoral fin spotted with white, but only the lower half of this area. In the present species the white spots are more variable and scattered over the entire dark area. *L. punctipectoralis* has a shorter pectoral, reaching  $2\frac{1}{2}$  to caudal base. In the specimen before me of *L. kishinouyei*, as well as in Snyder's figure of the type, the pectoral reaches half way to the caudal base.

Also a paratype, U.S.N.M. no. 98980. (2944.) D. 5392. Tubig Point, N. 49° E., 5 miles (lat. 12°12'35" N., long. 124°2'48" E.), between Samar and Masbate. In 135 fathoms. March 13, 1909. Length 160 mm.

(*punctus*, spot + *pectoralis*, pectoral.)

LEPIDOTRIGLA MACROBRACHIUM, new species

FIGURE 52

Depth  $3\frac{2}{3}$  (in length from snout tip); head  $2\frac{1}{2}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{2}{5}$  in head; eye  $3\frac{2}{5}$ ,  $1\frac{1}{4}$  in snout, greatly exceeds interorbital; maxillary reaches  $\frac{4}{5}$  to eye, length  $2\frac{2}{3}$  in head; mouth width  $2\frac{1}{4}$ ; teeth minutely villiform, in narrow band in each jaw, none on palate; interorbital  $6\frac{2}{3}$ , very deeply concave. Gill rakers 0+9, of which lowest 3 very small rudiments; longest  $3\frac{1}{2}$  in eye,  $1\frac{1}{4}$  in gill filaments, which  $1\frac{1}{2}$  in eye.

Pair of short, broadly triangular rostral spines, length 3 in eye, their edges denticulate; 2 strong antero-supraorbitals each side, also 2 close set strong postero-supraorbitals on little prominence followed by deep transverse groove, forming deep notch in upper profile of head; pair of moderate occipital spines; postocular keel terminated by spine posteriorly; suprascapular spine rather small, strong; suborbital stay with low ridge only across preopercle, ending in small short spine at preopercle angle on margin; opercle with small spine nearly level with lower edge of eye; humeral plate with long pointed spine, besides small obtuse spine on upper part of edge.

Scales 44 in lateral line to caudal base; 2 above opposite second dorsal origin, 14 below; 5 predorsal. Chest, breast, prepectoral region and area narrowly behind bases of paired fins naked. Caudal largely scaly, at least basally. Along dorsal bases 22 bony plates, each bearing strong spine, of these 9 along base of first dorsal. Scales in lateral line enlarged and narrowly imbricated; each tube simple. Scales with 5 or 6 basal radiating striae; 9 or 10 strong, short, apical denticles; circuli moderate, obsolete apically.

D. IX-14, front edge of first spine serrated, second spine  $1\frac{7}{8}$  in head, seventh ray  $2\frac{2}{5}$ ; A. 14, 1, seventh ray  $3\frac{3}{5}$ ; caudal  $1\frac{2}{5}$ , concave behind; least depth of caudal peduncle 2 in eye; pectoral reaches  $1\frac{1}{6}$  to caudal base, length  $1\frac{3}{4}$  in fish from snout tip to caudal base, uppermost of 3 lower detached rays  $1\frac{3}{5}$  in upper section of fin, rays II, 6, III—III; ventral rays I, 5, reach third anal ray, fin  $1\frac{1}{3}$  in head.

Pale brown on head, whitish below. Body light brown on upper half, lower half white, with line of demarcation distinct. Iris pale, whitish, gray above. Long pectoral largely gray black, marked with very numerous, variable white round spots, margin of fin most all around white, and on outer face each ray edged narrowly with white. Fins otherwise all whitish.

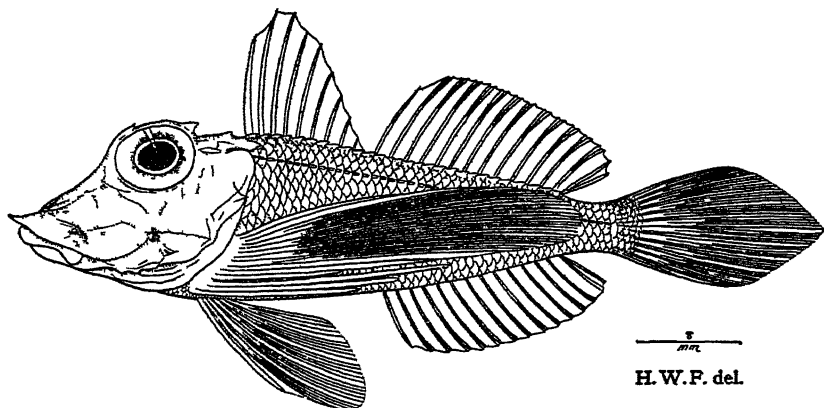


FIGURE 52.—*Lepidotrigla macrobrachium*, new species Type.

*Type*.—U.S.N.M. no. 98862. (4388.) D. 5432. Corandagos Island (NW.), N. 30' E., 5.7 miles (lat.  $10^{\circ}37'50''$  N., long.  $120^{\circ}12'$  E.), eastern Palawan and vicinity. In 51 fathoms. April 8, 1909. Length 64 mm.

*Remarks*.—Approaches *Lepidotrigla japonica* (Bleeker) of Japan, but that species with shorter pectoral largely uniformly blackish, smaller scales, and less prominent armature. Known only from the type.

(μακρός, long+βραχίον, arm or pectoral.)

#### PACHYTRIGLA, new genus

*Type*.—*Pachytrigla marisinensis*, new species.

Body elongately ovoid, compressed, tapers back evenly from head. Head short, deep, front profile steep. Snout moderate. Eye large, high, largely in front of second half of head. Mouth low, short, broad. Maxillary not reaching below eye. Teeth minute, in bands in jaws, none on palate. Interorbital deeply concave, bounded by

notch or groove posteriorly and along upper postocular. Gill rakers short, strong points. Gill opening large, extends well forward or opposite middle of snout. Pair of broad, triangular rostral spines. Humeral spine well developed, others small or obsolete. Scales very firmly adherent, regular. Row of strong spiny bucklers along bases of dorsals, those of first dorsal flat, asperous, their hind edges dentate, which gives place to a large single spine along base of second dorsal. Scales of lateral line anteriorly deep, narrowly imbricated and much deeper than posterior scales. First dorsal half length of second. Anal opposite second dorsal and similar. Caudal moderate, truncate. Pectoral short, reaches front of anal. Ventral little shorter than pectoral.

In this genus, which I separate from *Lepidotrigla*, the anterior bucklers along the base of the first dorsal are flattened and their hind edges dentate. In *Lepidotrigla* these bucklers all form a keel, like those along the base of the second dorsal, each bearing a single large spine. *Lepidotrigla* also differs further in that the broad rostral spines are more or less spinigerous, entire in *Pachytrigla*.

(παχύς, thick + *Trigla*.)

**PACHYTRIGLA MARISINENSIS, new species**

**FIGURE 53**

Depth 4 in length from snout tip; head  $3\frac{1}{8}$ , width  $1\frac{1}{5}$ . Snout  $2\frac{1}{10}$  in head, eye 4, 2 in snout,  $1\frac{1}{10}$  in interorbital; maxillary reaches  $\frac{4}{5}$  to eye, length  $3\frac{1}{4}$  in head; mouth width  $2\frac{2}{5}$ ; band of minute villiform teeth in each jaw, none on palate; interorbital  $3\frac{1}{8}$ , deeply depressed concavely. Gill rakers 0+9, low points, lower 4 mere rudiments; longest  $\frac{2}{3}$  of gill filaments, which  $3\frac{1}{5}$  in eye.

Two broad, flat, triangular rostral spines, length  $1\frac{1}{2}$  in eye; supra-orbital ridge with slight notch over hind eye edge; broad, strong suprascapular spine, length half of eye; ridge of suborbital stay very feeble, only evident below eye, without spine at preopercular angle; very small, short opercular spine, below lower eye edge; large triangular humeral plate ending in a slender pointed spine 3 in head.

Scales 56 in lateral line to caudal base; 4 above until opposite second dorsal origin, 16 below to anal origin; 7 predorsal. Chest, breast, and region rather narrowly behind paired fins naked, also prepectoral region. Most all of caudal finely scaled, though more densely so basally. Along dorsal bases 24 strong bucklers, first 8 along spinous dorsal at first broad with their hind edges with several serrae which progressively or at second fin form but a single strong spine to each buckler. Lateral line conspicuous, rather high



and straight, first tubes as 6 branches which diminish to a simple branch on posterior scales. Scales with 4 or 5 basal radiating striae; 12 to 20 short broad apical denticles; circuli fine, obsolete or ends abruptly terminally.

D. IX-16, 1, third spine  $2\frac{2}{3}$  in head, fourth ray  $3\frac{3}{4}$ ; A. 16, 1, sixth ray 4; caudal  $1\frac{2}{3}$ , truncate, only slightly emarginate as contracted; least depth of caudal peduncle  $1\frac{2}{5}$  in eye; pectoral reaches front part of anal or  $2\frac{2}{5}$  to caudal base, rays 1, 6, IV-III, fin  $1\frac{1}{6}$  in head; ventral  $1\frac{1}{4}$ , rays I, 5.

Pale brown above, under half of body whitish. Iris pale, evidently white in life. Upper section of pectoral largely blackish gray, especially terminally, edge all around whitish and each ray edged with white.

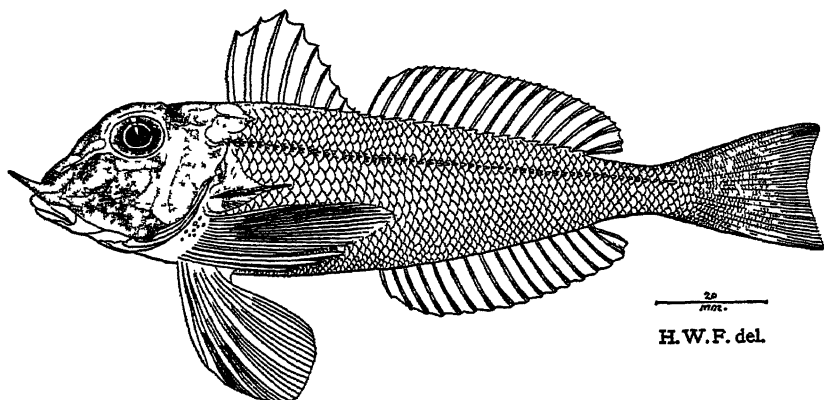


FIGURE 53.—*Pachytrigla marisinensis*, new genus, new species. Type.

*Type*.—U. S. N. M. no. 98867. (2694.) D. 5302. Lat.  $21^{\circ}42'$  N., long.  $114^{\circ}50'$  E., China Sea. In 38 fathoms. August 9, 1908. Length 147 mm.

Known only from the type.

(Named for the China Sea.)

#### BOVITRIGLA, new genus

*Type*.—*Bovitrigla acanthomoplate*, new species.

Body elongately ovoid, well compressed. Head rather large, deep, compressed. Snout little less than head, its front upper profile straight. Eye large, well impinging on upper profile, largely within front of last half of head. Mouth low, nearly horizontal. Maxillary not reaching eye. Teeth minute, in fine bands in jaws, feeble short band on vomer, none on palatines. Interorbital broad, deeply concave. Pair of strong, acuminate rostral spines, directed forward, nearly long as eye. Small postero-supraorbital spine. Long, strong, suprascapular spine. Similar humeral spine. Ridge of suborbital

stay feeble, ends in short spine at angle of preopercle. Opercular spine small. Scales small, firmly adherent, hastate and each ending in an apical spine. Patch of scales across breast. Row of imperfect scabrous plates along each side of first dorsal base, none along second dorsal. Lateral line distinct, complete, little high along side of body. Dorsal with 8 spines, but little shorter than soft fin. Anal opposite to and like soft dorsal, origin little advanced. Caudal moderate, but little emarginate. Pectoral long, reaches little over half way to caudal. Ventral reaches vent.

Related to *Pterygotrigla* Waite, 1899, but that genus with a very short suprascapular spine, shorter rostral spines, and no postero-supraorbital spines.

*Pterygotrigla ryukyuensis* Matsubara and Hiyama, 1932, may belong in the present genus, rather than in *Pterygotrigla*, as here understood. Its squamation is not described, and judged from the figure the scales would appear to be rounded rather than ending in an apical spine as in *Bovitrigla*. The condition of the breast is not given.

Quite likely *Otokime* Jordan and Starks, 1907, based on *Trigla hemistiota* Schlegel, is a valid genus. Its different physiognomy, together with the greatly enlarged and elongate opercular spine, is diagnostic.

*Trigla leptacanthus* Günther is evidently a member of the present genus, though it differs from the genotype in various minor items specifically.

(*bos*, bull + *Trigla*.)

#### BOVITRIGLA TRIACANTHUS (Günther)

*Trigla triacanthus* GÜNTHER, Report on the scientific results of the voyage of H. M. S. *Challenger*, vol. 1, pt. 6, p. 42, pl. 18, fig. B, 1880 (type locality, Ki Islands, in 129 fathoms).

Differs from *Bovitrigla acanthomoplate* in the greatly shorter humeral spine, narrower interorbital, shorter maxillary, uppermost of lower 3 detached pectoral rays reaching only well short of anal or perhaps only to vent, and its details of coloration. Günther does not mention the scales on the breast, if present, and his figure fails to reveal any.

#### BOVITRIGLA ACANTHOMOPLATE, new species

#### FIGURE 54

Depth 4 in body measured from snout tip; head  $2\frac{3}{8}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{1}{8}$  in head from snout tip; eye  $3\frac{7}{8}$ ,  $1\frac{7}{8}$  in snout,  $1\frac{1}{8}$  in interorbital; mouth width 3; maxillary reaches  $\frac{3}{4}$  to eye, length  $2\frac{7}{8}$  in head from snout tip; band of very fine villiform teeth in each

jaw; small, short transverse band of minute, feeble teeth on vomer; palatines toothless; interorbital deep, broadly depressed concavely. Gill rakers 1+9, of which lowest 4 mere short, low, weak rudiments; lanceolate, subequal with gill filaments or 3 in eye.

Pair of broad, flat, divergent rostral spines, extended forward, long as eye; small postero-orbital spine; long, slender suprascapular spine, flaring out and back, about 3 in head; ridge of suborbital stay but feeble keel, ends in small sharp spine at preorbital angle reaching gill opening; slender, pointed opercular spine, little below level of eye; long humeral spine horizontal, about 3 in head.

Lateral line with 50 scales in its course to caudal base; 10 above, 22 below; 10 predorsal. Row of 9 more or less ill defined scabrous bucklers along each side of base of first dorsal. Body and

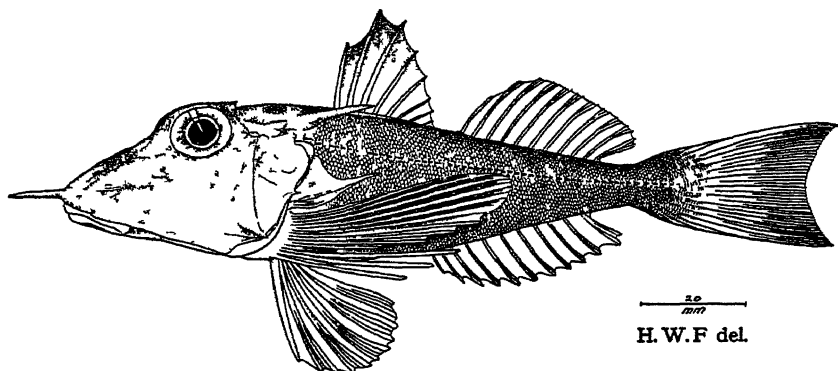


FIGURE 54—*Bovitrigla acanthomplate*, new genus new species. Type

tail largely with fine scales, some extending on base of caudal; middle and sides of breast with small scales, chest, prepectoral region and area around bases of paired fins naked, though belly covered with fine close set scales. Scales small, pear-shaped, each ending in a single apical spine; basal portion trilobate; circuli imperfect, uneven.

D. VIII-11, I, second spine  $2\frac{1}{4}$  in head, fourth ray  $2\frac{3}{4}$ ; A. I. 11, I, eighth ray  $3\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ , hind edge obliquely and slightly emarginate; least depth of caudal peduncle 2 in eye; pectoral  $1\frac{1}{10}$  in head, rays II, 5, V-III, uppermost of 3 detached rays  $1\frac{2}{5}$  in upper section of pectoral fin; ventral  $1\frac{3}{5}$  in head, rays I, 5, fin reaches vent.

Brown, with traces of gray or silvery sheen on sides of head. Under surface of head, chest, breast, prepectoral region and belly silvery white. Iris pale, evidently white. Fins all pale or light. First dorsal with first to third membranes on outer half dull brownish. Second dorsal marginally brownish. Upper part of pectoral,

over greater part of its upper section gray black, edge pale or whitish all around, and outer face of fin edge of each ray narrowly whitish. Three detached rays and front margin of ventral broadly whitish.

*Type*.—U.S.N.M. no. 98869. (2223.) D. 5519. Point Tagolo Light, S. 71° W., 8.7 miles (lat. 8°47' N., long. 123°31'15" E.), vicinity of northern Mindanao. In 182 fathoms. August 9, 1909. Length 150 mm.

*Remarks*.—Apparently related to *Pterygotrigla ryukyuensis* Matsubara and Hiayama 1932, Ryukyu Islands, based on a specimen 260 mm long. That species differs noticeably in its much broader and shorter rostral spines, more narrow predorsal plate, absence of the postero-supraorbital spine, shorter and less divergent suprascapular spines and shorter pectoral.

(ἄκανθα, spine + ὤμοπλάτη, shoulder-blade.)

#### DIXIPHISTOPS, new genus

*Type*.—*Dixiphistops megalops*, new species.

Body elongately ovoid, well compressed. Head deep, moderate, compressed. Snout moderate, depressed, much shorter than rest of head. Eye very large, well impinging on upper profile, center little behind middle in head length measured from snout tip. Mouth moderate, terminal, low, nearly horizontal. Maxillary reaches opposite front of eye, well expanded behind and slips below preorbital. Interorbital deeply concave. Nostrils small, well separate and hind pair midway in snout. Gill rakers long, lanceolate. Gill opening wide, extends forward about last fourth in snout. Head largely with surfaces of bones finely rugose striate. Each side of snout a long, flat, slender, acuminate spine, at least  $\frac{2}{3}$  rest of head. Small pair of spines between posterior nostrils. Ridge of suborbital stay well marked, entire or without spines. Strong depressed spine back from each side of occiput. Opercular spine small. Rather long, slender, humeral spine. Each side of spinous dorsal 8 rugose bony bucklers, besides one close before fin. No bony bucklers along base of soft dorsal, though each ray with a small, short basal spine each side. Lateral line complete, high along side, composed of moderate tubes. Scales minute, rather irregular, and firmly adherent. Dorsal spines 7, slender, fin  $\frac{3}{4}$  of soft dorsal. Anal opposite soft dorsal, similar. Caudal little emarginate. Pectoral moderate, reaches half way to caudal base; fin in 2 sections, with lowest rays of upper section graduated short; uppermost ray of lower section little longer than upper section of fin. Ventral short, reaches vent.

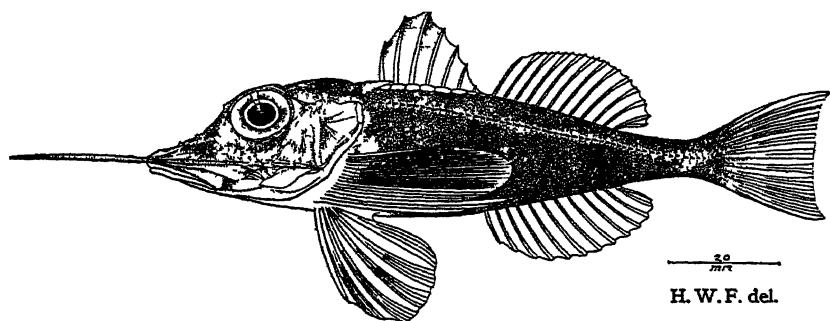
(δα, divided + ξιφος, sword + ὤψ, appearance.)

## DIXIPHISTOPS MEGALOPS, new species

FIGURE 55

Depth  $3\frac{4}{5}$  in length from snout tip; head from snout tip (not tip of rostral extensions)  $2\frac{1}{2}$ , width 2. Snout  $2\frac{2}{5}$  in head; eye  $3\frac{1}{3}$ ,  $1\frac{1}{3}$  in snout, little greater than interorbital; maxillary reaches below front eye edge, expansion 3 in eye, length  $2\frac{2}{5}$  in head; bands of very minute, fine, villiform teeth in jaws, concealed in closed jaws; no teeth on palate; bony rostral extension on each side of end of snout  $1\frac{1}{2}$  in rest of head; interorbital 4 in head, rather deeply concave. Gill rakers  $3+17$ , slender,  $2\frac{1}{2}$  in eye; 2 above and 7 below very short, low rudiments; gill filaments  $\frac{1}{5}$  of eye or  $\frac{2}{5}$  of gill rakers.

A very low, blunt, obtuse, supraorbital posterior knob; long, strong spine projecting back each side of occiput reaching spinous dorsal origin; very small, low spine above each posterior nostril; keel of suborbital stay distinct, entire, ends in a single short spine

FIGURE 55.—*Dixiphistops megalops*, new genus, new species Type.

behind at angle of preopercle edge, spine not quite reaching gill opening; opercle with small spine, level with lower part of eye; large, slender humeral spine, little inclined upward and backward, length  $1\frac{1}{4}$  in eye. Row of rugose striate bucklers along base of spinous dorsal, one also just in front of fin invading about  $\frac{1}{3}$  of predorsal space, which otherwise finely scaled. Soft dorsal without bucklers though on each side of base a very small, inconspicuous, short spine, very evident as the finger is drawn along the base of the fin.

Scales minute, irregular, largely little or nonimbricate; chest, breast, prepectoral region, and space behind bases of paired fins naked. Lateral line distinct, tubes 53 in its course to caudal base. Bones of head all more or less finely and smoothly rugose striate.

D. VII-12, third spine  $2\frac{2}{3}$  in head from snout tip, third ray  $3\frac{1}{10}$ ; A. 12, 1, eighth ray  $3\frac{3}{7}$ , fin edge not notched; caudal  $1\frac{2}{3}$ , hind edge little concave and end of each lobe pointed; least depth of caudal peduncle 2 in eye; pectoral moderate, reaches front part of anal, fin

length  $1\frac{1}{5}$  in head, rays 1, 8, IV-III, uppermost of 3 lower detached rays slightly longer than upper section of fin; ventral inserted little before pectoral base, with spine and 5 rays, fin length  $1\frac{1}{3}$  in head from snout tip.

Very pale or light brown. Iris light yellowish, evidently whitish in life. Back little more brownish than belly, below more whitish. Fins all more or less pale to whitish. Spinous dorsal whitish, anterior membranes terminally dark brown. Pectoral dark gray or brown medially, border pale all around.

*Type*.—U.S.N.M. no. 98879. (3679.) D. 5441. San Fernando Point Light, S.  $87^{\circ}$  E., 18.7 miles (lat.  $16^{\circ}38'$  N., long.  $119^{\circ}57'18''$  E.), west coast of Luzon. In 186 fathoms. May 10, 1909. Length 146 mm.

Diagnosis in the genus.

(μῆγᾶς, large + ὤψ, eye.)

#### DIXIPHISTES, new genus

*Type*.—*Dixiphistes macrorhynchus*, new species.

Body elongately ovate, well compressed. Head long, compressed, attenuated. Snout long, extended, so that muzzle more than half of head. Eye large, elevated, impinging on upper profile, anteriorly in posterior half of head. Mouth rather small, terminal, low; nearly horizontal. Maxillary not quite reaching  $\frac{3}{4}$  to eye, well expanded behind and slips below preorbital. Interorbital deeply concave. Nostrils small, well separated and hind pair at first  $\frac{2}{5}$  in snout. Gill rakers long, lanceolate. Gill opening wide, extends forward well before eye. Head largely with surfaces of bones finely rugose striate. Each side of snout a long, flat, slender, acuminate spine, at least  $\frac{2}{3}$  rest of head. Ridge of suborbital stay well marked, entire or without spines. Strong spine back from each side of occiput. Opercular spine small. Large humeral spine, with broad, flat, striate basal portion. Each side of spinous dorsal 8 rugose bony bucklers, besides large one just before fin. No bony bucklers along base of soft dorsal, though each ray with a small, short, basal spine each side. Lateral line complete, high along side, composed of rather large tubes. Scales minute, rather irregular, and firmly adherent. Dorsal spines 7, slender, fin little over half soft dorsal. Anal opposite soft dorsal, similar. Caudal little emarginate. Pectoral very long, reaches  $\frac{3}{5}$  to caudal base; fin in 2 sections, with lowest rays of upper section graduated short; uppermost ray of lower section little longer than upper section of fin. Ventral short, reaches vent.

This very interesting genus is the extreme of the group of genera with a pair of flattened, acuminate rostral extensions forward. It

differs in the elongated snout, with the maxillary falling well short of the eye, the uppermost ray of the lower section of the pectoral fin longer than the upper section of the fin, its armature of the head, bucklers, scales, etc.

( $\delta\iota\alpha$ , divided +  $\xi\iota\phi\omicron\varsigma$ , sword.)

**DIXIPHISTES MACRORHYNCHUS, new species**

**FIGURE 56**

Depth  $4\frac{1}{2}$  in length from snout tip; head from snout tip (not tip of rostral extensions)  $2\frac{1}{3}$ , width  $2\frac{4}{5}$ . Snout  $1\frac{3}{4}$  in head; eye  $4\frac{3}{4}$ ,  $2\frac{3}{5}$  in snout, subequal with interorbital; maxillary reaches  $\frac{2}{3}$  to eye, expansion 2 in eye, length  $2\frac{2}{3}$  in head; band of minute villiform teeth in each jaw, upper exposed when mouth closes; no teeth on palate; bony rostral extension each side of end of snout  $1\frac{1}{2}$  in rest of head; interorbital  $4\frac{7}{8}$  in head, deeply concave. Gill rakers 3+13, slender,  $1\frac{1}{2}$  in eye; gill filaments  $\frac{2}{3}$  of gill rakers.

No supraorbital spines; strong, backward-projecting spine, each side of occiput reaching spinous dorsal origin; keel of suborbital stay distinct, entire, ends in single, moderate spine behind at angle of preopercle edge, spine projecting slightly behind gill opening; opercle, with small spine, level with lower part of eye; large strong humeral spine, length  $\frac{4}{5}$  of eye. Row of rugose striate bucklers along base of spinous dorsal, one also just in front of fin but invades only about  $\frac{1}{3}$  of predorsal space, which otherwise smooth and scaleless; bucklers without any spines. Soft dorsal without bucklers though on each side of base a very small, inconspicuous, short spine, very evident if the finger is drawn along the base of the fin.

Scales minute, irregular, largely little or nonimbricate; absent from predorsal and narrow strip below bucklers of spinous dorsal, chest, breast, prepectoral and region behind bases of paired fins. Lateral line distinct, tubes 52 in its course to caudal base. Bones of head all more or less finely and smoothly rugose striate.

D. VII—I, 11, third spine 3 in head from snout tip, third ray  $3\frac{1}{4}$ ; A. 12, 1, fifth ray  $4\frac{1}{2}$ , fin edge not notched; caudal  $1\frac{3}{4}$ , hind edge slightly concave and end of each lobe pointed; least depth of caudal peduncle  $1\frac{4}{5}$  in eye; pectoral very long, reaches middle of soft anal or dorsal, fin length  $2\frac{3}{4}$  in fish from snout tip to caudal base; rays 10, v—iii, uppermost of 3 lower detached rays slightly longer than upper section of fin; ventral inserted little before pectoral base, with spine and 5 rays, fin length  $1\frac{3}{4}$  in head from snout tip.

Head pale or very light brown, with traces of whitish or silvery reflections. Iris whitish, with gray. Back and body brown, with silvery or white on belly. Fins all more or less pale or whitish.

Spinous dorsal brownish terminally. Upper section of pectoral grayish, with 4 rather ill defined transverse dark or blackish bands. Ventral with outer portions of third and fourth membranes each with a dark brown bar.

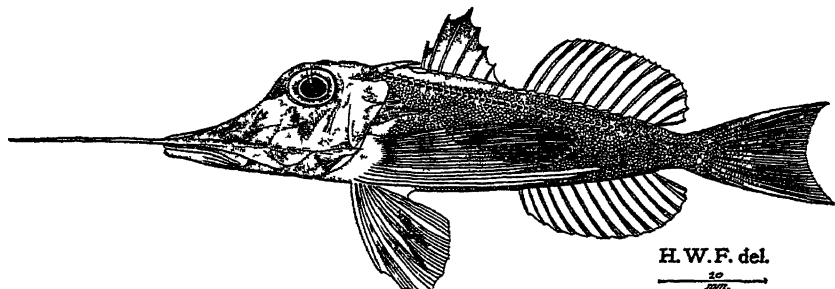


FIGURE 56—*Dimphestes macrorhynchus*, new genus, new species. Type

*Type*.—U.S.N.M. no. 98875. (2222.) D. 5519. Point Tagolo Light, S.  $71^{\circ}$  W., 8.7 miles (lat.  $8^{\circ}47'$  N., long.  $123^{\circ}31'15''$  E.). In 182 fathoms. August 9, 1909. Length 159 mm.

Diagnosis contained in that of its genus.

(μακρός, long + ρύγχος, snout.)

#### DIXIPHICHTHYS, new genus

*Type*.—*Dixiphichthys hoplites*, new species.

Body elongately ovate, well compressed. Head moderate, rather well compressed. Snout moderate, depressed, shorter than rest of head. Eye moderate, elevated, impinging on upper profile, largely with anterior portion in posterior half of head. Mouth moderate, terminal, low, nearly horizontal. Maxillary not quite reaching eye, well expanded behind and slips below preorbital. Interorbital deeply concave. Nostrils small, well separated and posterior midway in snout length. Gill rakers long, lanceolate. Gill opening wide, extends forward well before eye. Head largely with surfaces of bone rugose striate. Each side of snout a long, flat, slender, acuminate spine, at least little over half of rest of head. Ridge of suborbital stay well marked, entire, or without spines. Long, strong spine back from each side of occiput. Opercular spine small. Short, strong humeral spine. Along base of spinous dorsal row of scabrous scales, small and each with short pointed spine. No bucklers along base of soft dorsal, though each ray with a small, short basal spine each side. Lateral line complete, high along side, composed of rather large tubes. Dorsal spines 8, slender, fin little less than half of soft dorsal. Anal opposite soft dorsal, similar. Caudal nearly truncate. Pectoral very long, reaches  $\frac{4}{5}$  to caudal base; fin in 2 sections, with



lowest rays of upper section graduated short; uppermost ray of lower section little more than half length of upper section of fin. Ventral reaches vent.

Close to *Diaphistes* but with a longer pectoral, though lower section of fin greatly shorter, shorter snout, more dorsal spines and stronger armature of the head. The absence of bony bucklers around the base of the spinous dorsal will distinguish this genus from both *Diaphistes* and *Diaphistops*.

(*δία*, divided + *ἔλφος*, sword + *ἰχθὺς*, fish.)

**DIXIPHICHTHYS HOPLITES**, new species

FIGURE 57

Depth  $3\frac{2}{3}$  in length from snout tip; head from snout tip (not tip of rostral extensions)  $2\frac{2}{3}$ , width  $1\frac{7}{8}$ . Snout  $2\frac{1}{5}$  in head; eye 4,  $1\frac{3}{4}$  in snout, slightly greater than front part of interorbital; maxillary reaches  $\frac{7}{8}$  to eye, expansion  $2\frac{1}{3}$  in eye, length  $2\frac{2}{5}$  in head; bands of very minute, fine, villiform teeth in jaws, concealed in closed jaws; no teeth on palate; bony rostral extension on each side of end of

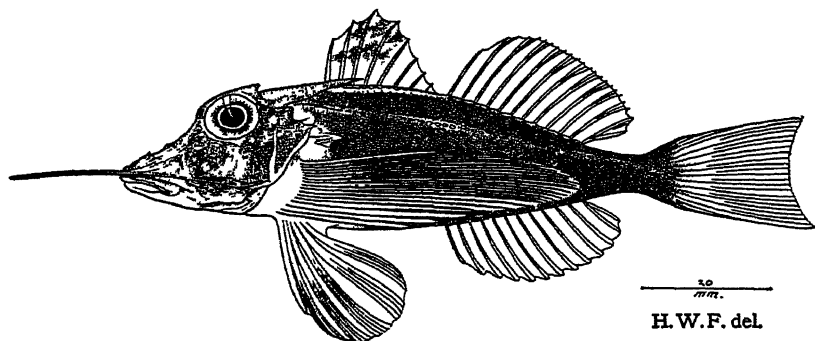


FIGURE 57.—*Dixiphichthys hoplites*, new genus, new species. Type.

snout 2 in rest of head; front part of interorbital width  $4\frac{1}{8}$  in head, rather deeply concave. Gill rakers 4 + 13, of which 2 above low rudiments; gill rakers  $2\frac{1}{2}$  in eye; gill filaments  $\frac{3}{5}$  of gill rakers.

Pair of very short, low, sharp, wide set spines between hind nostrils; broad, strong, low, obtuse postero-supraorbital spine; long, strong spine, projects back each side of occiput and reaches base of second or third dorsal spine; keel of suborbital stay distinct, entire, ends in a single, short, low spine at preopercle angle, not reaching gill opening; opercle with small spine, level with lower part of eye; short, strong, pointed, humeral spine, little inclined,  $1\frac{1}{3}$  in eye. Row of small, scabrous scales along each side of base of spinous dorsal,

each bearing a small, low spine. Soft dorsal with a low, inconspicuous, short spine each side basally of each ray, very evident as the finger is drawn along the base of the fin.

Scales very minute, in oblique rows along side of body, chest, breast, prepectoral, space around bases of paired fins, and narrow loop around front of spinous dorsal naked. Lateral line distinct, tubes 50 in its course to caudal base. Bones of head all minutely rugose striate, rough velvety to touch.

D. VIII-12, 1, fourth spine  $3\frac{1}{8}$  in head from snout tip, fifth ray  $2\frac{1}{4}$ ; A. 12, eighth ray  $2\frac{5}{8}$ , fin edge not notched; caudal  $1\frac{2}{5}$ , its hind edge very slightly concave; least depth of caudal peduncle  $1\frac{3}{4}$  in eye; pectoral long, reaches  $1\frac{1}{4}$  to caudal, fin length 2 in fish from snout tip to caudal base, rays 1, 8, IV-III, uppermost of 3 lower detached rays  $1\frac{3}{8}$  in upper section of fin; ventral inserted little before pectoral base, with spine and 5 rays, fin length  $1\frac{2}{5}$  in head from snout tip.

Pale or light brownish, most of head and belly whitish. Iris pale, evidently white in life. Spinous dorsal with membranes brownish terminally. Membranes of upper section of pectoral, connecting branched rays, gray black, edge of fin rather narrowly whitish.

*Type*.—U.S.N.M. no. 98874. (4143.) D. 5516. Port Tagolo Light (Mindanao), S.  $80^{\circ}$  W., 9.7 miles (lat.  $8^{\circ}46'$ , N., long.  $123^{\circ}32'30''$  E.), vicinity of northern Mindanao. In 175 fathoms. August 9, 1909. Length 134 mm.

Also paratype, U.S.N.M. no. 98982. (1435.) D. 5412. Lauis Point Light, N.  $21^{\circ}$  E. 5.5 miles (lat.  $10^{\circ}9'15''$  N., long.  $123^{\circ}52'$  E.), between Cebu and Bohol. In 162 fathoms. March 23, 1909. Length 128 mm.

(ὄπλιτης, armed.)

### Family PERISTEDIIDAE

#### GARGARISCINAE, new subfamily

Type genus, *Gargariscus* H. M. Smith. Upper jaw with teeth. lower toothless.

Includes *Gargariscus* and *Heminodus*.

#### Genus GARGARISCUS H. M. Smith

##### GARGARISCUS PRIONOCEPHALUS (Duméril)

*Peristedion undulatus* Weber, 1913 = *Gargariscus semidentatus* H. M. Smith, 1917, both to fall with *Peristethidion prionocephalum* Duméril 1868.

Of *G. semidentatus* H. M. Smith I have examined the type and other Philippine material.

Genus **HEMINODUS** H. M. Smith**HEMINODUS PHILIPPINUS** H. M. Smith

The type and other Philippine material examined.

Subfamily **PERISTEDIINAE**

Type genus, *Peristedion*. Both jaws toothless.

Includes *Peristedion*, *Satyrichthys*, *Nemaperistedion*, and *Scalicus*.

Genus **PERISTEDION** Lacépède**PERISTEDION AMBLYGENYS**, new species

## FIGURE 58

Depth  $5\frac{1}{5}$  in body measured from snout tip inside rostral extensions; head  $3\frac{1}{8}$ , width  $1\frac{2}{5}$ . Snout  $2\frac{1}{4}$  in head; eye 4,  $1\frac{2}{3}$  in snout, little greater than interorbital; maxillary extends  $\frac{4}{5}$  to eye, length 3 in head; mouth width  $2\frac{7}{8}$ ; barbel  $2\frac{1}{4}$ , with 6 tufts of several small filaments; anteriorly each side of mandibular symphysis tuft of small filaments and 4 tufts on inner edge of each ramus of lower jaw anteriorly; mouth endentulous; interorbital  $4\frac{1}{5}$  in head, deeply concave. Gill rakers 4+19, lanceolate, 3 in eye, twice gill filaments.

Pair of attenuated, long, flat, rostral extensions, long as snout, rather narrow interspace  $\frac{4}{5}$  width of either extension; single, strong, low, postero-supraorbital spine, keel extending back with broad, obtuse parietal angle and ends in large, strong, erect occipital spine; postocular keel ends in blunt suprascapular spine; opercle with pointed spine forming long keel forward long as eye; keel of suborbital stay with undulous edge though without any spines and simply obtuse posteriorly.

From above gill opening 35+1 bony lateral plates; 4 rows of diminishing spiniferous plates on trunk; spines all large, strong, erect and surfaces of plates rugose; hind pair of plates on belly before vent  $1\frac{3}{4}$  length of front pair; arc of 5 rather poorly developed scutes from over gill opening downward.

D. VIII, 20, third spine  $3\frac{1}{10}$  in head, fourth ray 3; A. 22, eighth ray  $3\frac{3}{4}$ ; caudal 3? (damaged); least depth of caudal peduncle  $3\frac{1}{2}$  in eye; pectoral  $2\frac{1}{5}$  in head, rays I, 11-II, upper detached ray  $1\frac{2}{5}$  in head or reaches base of fifth anal ray; ventral rays I, 5, fin 2 in head or reaches vent; vent with papilla  $\frac{1}{3}$  of eye.

Light brown, whitish below. Iris gray. Spinous dorsal with blackish margin above and soft dorsal with black marginal line. Pectoral whitish, with blackish terminally and transverse dark brown band.

*Type*.—U.S.N.M. no. 98870. (24377.) D. 5442. San Fernando Point Light, N.  $39^{\circ}$  E., 8.4 miles (lat.  $16^{\circ}30'36''$  N., long.  $120^{\circ}11'6''$  E.), west coast of Luzon. In 45 fathoms. May 10, 1909. Length 162 mm to end of broken caudal.

*Remarks*.—Also a series of Philippine specimens in 108 to 445 fathoms.

Differs from *Peristedion nierstraszi*, and *P. picturatum* in the supraorbital and occipital spines higher, snout longer, and the upper detached pectoral ray reaches front of anal. It agrees in the rostral extensions spineless and the dorsal spines 6.

μῆλὺς, obtuse + γέρως, chin.)

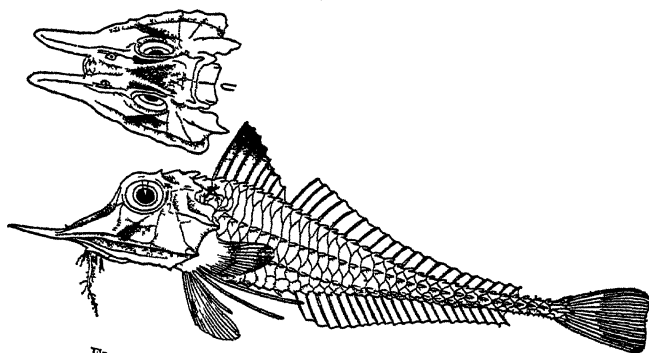


FIGURE 58.—*Peristedion amblygenys*, new species. Type. H.W.F. del.

### Genus SATYRICHTHYS Kaup

SATYRICHTHYS CLAVILAPIS, new species

FIGURE 59

Depth  $4\frac{2}{3}$  in length measured from snout tip inside rostral extensions; head  $2\frac{1}{3}$ , width  $1\frac{1}{2}$ . Snout  $1\frac{2}{10}$  in head; eye  $5\frac{1}{8}$ ,  $2\frac{3}{4}$  in snout, equals interorbital; maxillary extends  $\frac{4}{5}$  to eye, length  $2\frac{1}{4}$  in head; mouth width  $2\frac{1}{3}$ ; barbel  $3\frac{3}{8}$ , with 3 long filaments; pair of rather long lower mental filaments, one each side of mandibular symphysis, though no others; no teeth; interorbital  $5\frac{1}{4}$  in head, deeply concave, superciliary ridges broad and elevated. Gill rakers 6+18, of which 3 or 4 above and below small rudiments; length 3 in eye; gill filaments  $\frac{3}{5}$  of gill rakers.

Pair of broad, flattened, thin, attenuated, rostral extensions, longer than eye or equal to postocular space, interspace equals basal width of either extension; single and rather large postero-supraorbital spine each side, with keel leading back to large, strong occipital spine,  $\frac{1}{3}$  of eye; postocular keel ends in blunt, short suprascapular spine;

single, small, inconspicuous median spine on snout at last fourth its length; opercular spine small, slender, little below level of eye, with slight keel forward so its length equals eye; ridge of suborbital stay broad, flat keel, with finely serrate or denticulate edge, ending in long slender spine at angle of preopercle long as eye and with small short prebasal denticle externally, also preopercle spine reaching very little beyond base of uppermost pectoral ray or about  $\frac{1}{8}$  in fin length.

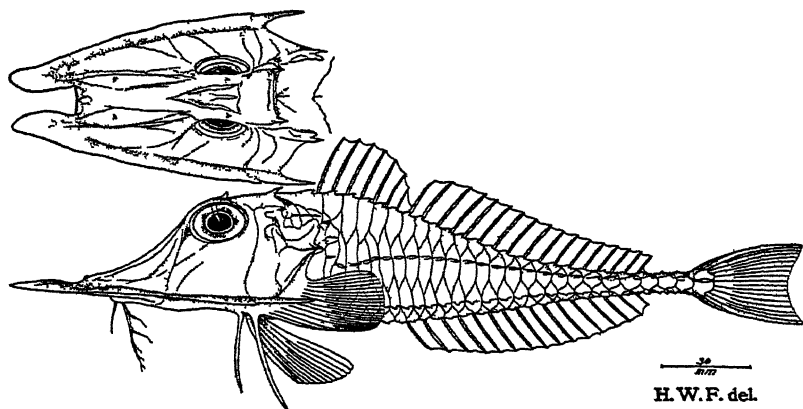


FIGURE 59—*Satyrichthys clavilaps*, new species. Type.

From above gill opening 27+1 bony lateral plates; 3 rows of diminishing spiniferous plates on trunk with an additional row on belly and under side of tail; spines all slender, sharp pointed, firm, and surfaces of plates rugose striate; front pair of plates on belly twice long as posterior pair close before vent; row of 3 small plates, each bearing horizontal keel ending in spine, above gill opening and subvertical row behind gill opening also of 3 small plates.

D. VII, 17, third spine  $3\frac{4}{5}$  in head, third ray  $4\frac{3}{5}$ ; A. 16, fifth ray 5; caudal  $2\frac{3}{5}$ , concave behind; least depth of caudal peduncle  $2\frac{4}{5}$  in eye; pectoral  $2\frac{2}{3}$  in head, rays 10, II-II, uppermost detached ray  $2\frac{2}{5}$  in head; ventral  $2\frac{1}{4}$ , rays I, 5.

Brownish, under surface of body whitish. Iris pale, evidently whitish or light in color. Dorsals with spines and rays each marked with 5 blackish brown small spots; along each side of base of fins more or less dark to blackish line, broken into many variable small spots.

*Type*.—U.S.N.M. no. 98868. (4742.) D. 5118. Sombrero Island, S. 47° E., 10 miles (lat. 13°48'45" N., long. 120°41'51" E.), Balayan Bay and Verde Island Passage. In 159 fathoms. January 21, 1908. Length 244 mm to end of broken rostral extensions.

*Remarks*.—Also a series of Philippine paratypes, in 37 to 394 fathoms.

Differs from *Nemaperistedion orientale* in its narrower and less expanded head, longer and slenderer rostral extensions with a broader interspace, the absence of an inner or upper spine at the preopercular angle, the presence of a prebasal external small spine to the preopercular opposite the front vertical border of the preopercle, greatly shorter mandibular barbel with fewer filaments, fewer mental filaments and none along inner edges of chin externally, and in the presence of a minute frontal spine on the snout before the eye.

(*clavis*, key + *lapis*, stone; with reference to the contour of the head as viewed above suggestive of the outline of a keystone.)

SATYRICHTHYS PIERCEI, new species

FIGURE 60

Depth  $4\frac{3}{4}$  in length measured from snout tip inside rostral extensions; head  $2\frac{1}{4}$ , width  $1\frac{1}{8}$ . Snout 2 in head; eye  $4\frac{2}{3}$ ,  $2\frac{1}{8}$  in snout, equals interorbital; maxillary extends  $\frac{4}{5}$  to eye, length  $2\frac{1}{2}$  in head; mouth width  $2\frac{1}{5}$ ; barbel  $2\frac{1}{4}$ , with 8 pairs of filaments; pair of rather long lower mental filaments each side of mandibular symphysis, and outer with small accessory filament; along front part of inner edge of each mandibular ramus 3 short filaments; no teeth; interorbital  $4\frac{3}{4}$ , deeply convex. Gill rakers 6+17, length  $3\frac{1}{5}$  in eye or twice gill filaments.

Pair of flat, thin, triangular, rostral extensions, long as eye, basal width of each equal to  $\frac{7}{8}$  of interspace; pair of small, erect, wide-set postnasal spines, little behind posterior nostrils or at first third in snout; single larger spine medially at last third in snout; single and rather large postero-supraorbital spine each side, keel posteriorly leading to large, strong, erect occipital spine,  $2\frac{1}{3}$  in eye; postocular keel ends in small, inconspicuous blunt end, scarcely a suprascapular spine; opercular spine slender, about level with lower edge of eye, with forward keel so its length nearly equals eye; ridge of sub-orbital stay trenchant, moderate, with finely serrate or denticulate edge, ending in long slender spine at angle of preopercle  $1\frac{1}{5}$  times eye and with short prebasal denticle externally, also preopercular spine reaching  $\frac{1}{4}$  in pectoral fin.

From above gill opening 28+1 bony lateral plates; 4 rows of diminishing spiniferous plates on trunk and tail; spines all triangular, rather small, firm, sharply pointed and surfaces rugose striate; hind pair of plates on belly before vent  $1\frac{4}{5}$  in front pair; arc of 5 small plates over and behind gill opening.

D. VII, 16, third spine  $4\frac{1}{8}$  in head, fourth ray  $3\frac{4}{5}$ ; A. 16, fourth ray 4; caudal  $2\frac{1}{4}$ , little concave behind; least depth of caudal peduncle  $2\frac{3}{4}$  in eye; pectoral  $2\frac{2}{3}$  in head, rays I, 12, I-II, reaches oppo-

site anal origin, upper of lower detached rays long as upper section of pectoral; ventral reaches vent, rays I, 5, fin  $1\frac{2}{3}$  in head.

Uniform brown, under surfaces pale or whitish. Spinous dorsal with outer part little deeper brown. Pectoral with some obscure brownish cloudings or blotches and also little deeper brown terminally. Fins otherwise pale to light brown.

*Type*.—U.S.N.M. no. 98877. (4394.) D. 5316. Lat.  $21^{\circ}39'$  N., long.  $117^{\circ}7'$  E., China Sea. In 159 fathoms. November 5, 1908. Length 151 mm.

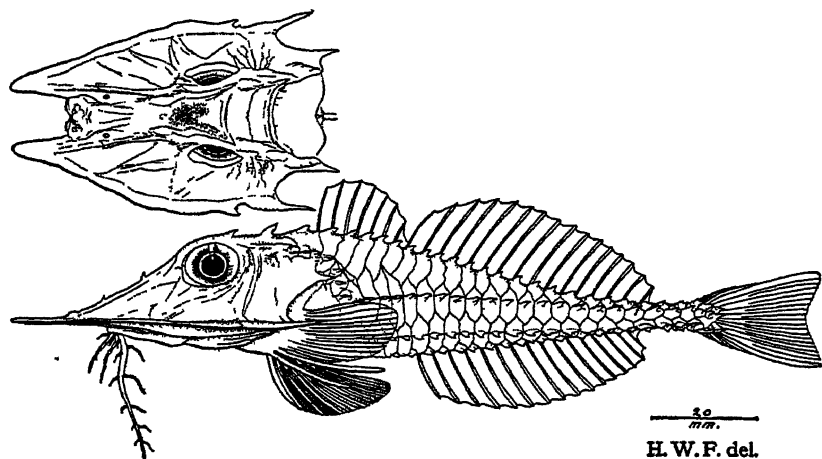


FIGURE 60.—*Satyrichthys piercei*, new species. Type.

*Remarks*.—Known only from the type. It differs from *Nemaperistedion orientale* in its greatly shorter barbel, though in many other respects is similar. Its rostral extensions are longer, and it is distinguished also by the presence of postnasal, rostral, and prebasal external preopercular spines.

(Named for Dr. Dwight L. Pierce, formerly of Iloilo, Philippines.)

#### NEMAPERISTEDION, new genus

*Type*.—*Nemaperistedion orientale*, new species.

Head as viewed from above of rather rhombic contour. Greatly elongated barbel reaches anal. Interorbital deeply concave. Preopercular spine long, reaches well on pectoral fin. No upper preopercular spine. Viewed from above rather wide interspace between rostral projections. Shields on belly rather broad.

Easily known by its very long barbels reaching vent or anal.

(*νήμα*, thread + *Peristedion*; with reference to its long barbels.)

## NEMAPERISTEDION ORIENTALE, new species

FIGURE 61

Depth  $4\frac{1}{3}$  in length measured from snout tip inside rostral extensions; head  $2\frac{3}{5}$ , width  $1\frac{1}{6}$ . Snout  $1\frac{7}{8}$  in head; eye  $4\frac{3}{5}$ ,  $2\frac{1}{5}$  in snout, little greater than interorbital; maxillary extends  $\frac{5}{6}$  to eye, length  $2\frac{1}{8}$  in head; mouth width 2; barbel long as head, reaches front of anal, with 10 pairs of filaments; 2 pairs anteriorly each side of lower mental filaments and 2 filaments on the inner edge of each mandibular ramus or chin, with posterior bifid; mouth edentulous; interorbital 5 in head; deeply concave, superciliary ridges elevated. Gill rakers  $6+19$ , of which 5 above and 1 below mere low rudiments; slightly longer than gill filaments or 4 in eye.

Pair of broad, flattened, rounded, rostral extensions,  $1\frac{1}{6}$  in eye and interspace equals basal width of either extension; very small, short, median rostral spine at last fourth in snout; small antero-supraorbital spine each side, and pair of postero-supraorbital spines, posterior greatly larger and erect; pair of large erect diverging occipital spines; postocular keel ends in short, small obtuse suprascapular spine; small, slender opercular spine with distinct keel, its length  $1\frac{2}{3}$  in eye; edge of keel of suborbital stay unevenly and slightly undulated, ends behind in long slender preopercular spine reaching  $\frac{1}{3}$  of pectoral, or its length subequal with eye; rather long asperous keel below and behind hind end of maxillary, followed by short one.

From above gill opening  $34+1$  bony lateral plates; 4 rows of diminishing spiniferous plates on trunk and tail; spines all large, strong, erect, and surfaces of plates rough rugose; hind pair of plates on belly before vent  $1\frac{3}{4}$  in length of front pair; row of 3 small plates, each bearing horizontal keel ending in short spine, above gill opening and 3 similar subvertical or inclined plates behind gill opening.

D. VII, 20, second spine  $4\frac{1}{4}$  in head, fifth ray  $4\frac{1}{10}$ ; A. 23, fourth ray  $5\frac{2}{5}$ ; caudal  $2\frac{1}{2}$ , little concave behind, truncate as expanded; least depth of caudal peduncle  $2\frac{4}{5}$  in eye; pectoral  $2\frac{1}{8}$  in head, rays  $\pi$ , 12,  $\text{I}-\pi$ , upper detached ray  $2\frac{1}{10}$  in head; ventral  $2\frac{1}{4}$ , rays I, 5.

Light brown, little paler to whitish below. Variable, scattered small brown spots on head and body above. Greater upper anterior portion of first dorsal blackish. Upper submarginal part of second dorsal anteriorly with narrow blackish brown streak. Pectoral slightly brownish submarginally. Fins otherwise all pale or whitish.

*Type*.—U.S.N.M. no. 98876. (3425.) D. 5623. Makyan Island, (S.) S.  $88^{\circ}$  W., 7.5 miles (lat.  $0^{\circ}16'30''$  N., long.  $127^{\circ}30'00''$  E.), between Gillolo and Makyan Islands. In 272 fathoms. November 29, 1909. Length 179 mm.



*Remarks.*—Also a series of paratypes from the East Indies and Philippines, in 195 to 310 fathoms:

(2482.) D. 5317. Lat.  $21^{\circ}36'$  N., long.  $117^{\circ}27'$  E., China Sea, vicinity of Formosa. In 230 fathoms. November 5, 1908. Length 178 mm.

(1961.) D. 5518. Point Tagolo Light, S.  $64^{\circ}$  W., 8.7 miles (lat.  $8^{\circ}48'$  N., long.  $123^{\circ}31'$  E.), northern Mindanao and vicinity. In 200 fathoms. August 9, 1909. Length 143 mm.

(1825.) D. 5222. San Andreas Island (W.), S.  $57^{\circ}$  E., 9.20 miles (lat.  $13^{\circ}38'30''$  N., long.  $121^{\circ}42'45''$  E.), between Marinduque and Luzon. In 195 fathoms. April 24, 1908. Length 141 mm.

(4131.) D. 5626. Kayoa Island (SE.), S.  $5^{\circ}$  W., 6.7 miles (lat.  $0^{\circ}7'30''$  N., long.  $127^{\circ}29'0''$  E.), between Gillolo and Kayoa Islands. In 265 fathoms. November 29, 1909. Length 171 mm.

(3269.) D. 5625. Kayoa Island (SE.), S.  $3^{\circ}$  W., 6 miles (lat.  $0^{\circ}7'0''$  N., long.  $127^{\circ}28'0''$  E.), between Gillolo and Kayoa Islands. In 230 fathoms. November 29, 1909. Length 175 mm.

(1615.) D. 5590. Mabul Island (NW.), N.  $22^{\circ}$  W., 4.3 miles (lat.  $4^{\circ}10'50''$  N., long.  $118^{\circ}39'35''$  E.), Sibuko Bay, Borneo, and vicinity. In 310 fathoms. September 29, 1909. Length 173 mm.

(24238.) No label. Length 173 mm.

(*orientalis*, eastern.)

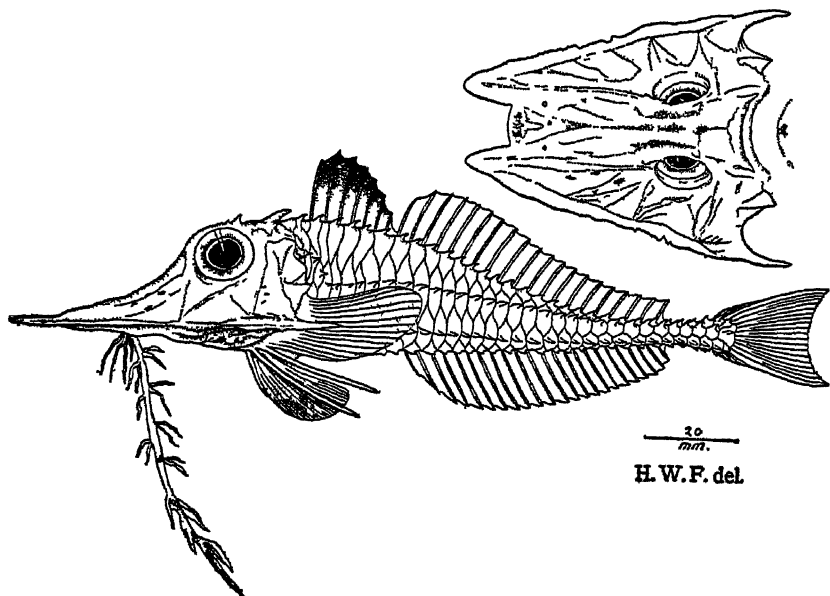


FIGURE 61.—*Nemaperistedion orientale*, new species.

## Family ELEOTRIDAE

## SYNOPSIS OF GENERA

*a*<sup>1</sup>. Head armed with one or more spines.

*b*<sup>1</sup>. ELEOTRINAE. Preopercle armed with single, small, more or less concealed spine directed down, or group of 3 to 5 small spines at angle; upper pectoral rays not silklike. (Type genus, *Eleotris* Schneider.)

*b*<sup>2</sup>. BELOBRANCHINAE. Preopercle unarmed; one or more branchiostegals end in front on under surface of head in a strong spine directed forward and upward; upper pectoral rays silklike. (Type genus, *Belobranchus* Bleeker.)

*a*<sup>2</sup>. Head without spines.

*c*<sup>1</sup>. No mental tentacle.

*d*<sup>1</sup>. OPHIOCARINAE. Head large, depressed, wide, lower jaw conspicuous. (Type genus, *Ophiocara* Gill.)

*e*<sup>1</sup>. Head without skinny flaps; branched dorsal rays 8 or 9; caudal less than head; color pattern little variegated----- *Ophiocara*

*e*<sup>2</sup>. Head with skinny flaps; branched dorsal rays 10; caudal greater than head with age; color pattern greatly variegated----- *Batracheleotris*

*d*<sup>2</sup>. VALENCIENNEINAE. Head moderate, compressed. (Type genus, *Valenciennia* Bleeker.)

*f*<sup>1</sup>. Dorsal spines usually elongated, sometimes front one may reach last dorsal ray.

*g*<sup>1</sup>. Soft dorsal with spine and 12 to 18 branched rays; anal with spine and 12 to 17 branched rays----- *Valenciennia*

*g*<sup>2</sup>. Soft dorsal with spine and 28 branched rays; anal with spine and 24 branched rays----- *Nemateleotris*

*f*<sup>2</sup>. Dorsal spines less than head; soft dorsal with spine and 11 branched rays; anal with spine and 12 rays; a dark transverse band across chest and another across middle of belly----- *Pteroculiops*

*c*<sup>2</sup>. POGONOCULINAE. Interspace between mandibular rami deep, with median free long tentacle; body with transverse bands. (Type genus, *Pogonoculius*, new genus.)----- *Pogonoculius*

## Subfamily OPHIOCARINAE

## BATRACHELEOTRIS, new genus

*Type*.—*Eleotris solateri* Steindachner.

Body rather robust, especially forward, where more or less depressed. Head moderate, depressed, robust, long as trunk. Muzzle short, depressed, obtuse. Eye high, little advanced in head. Mouth short, broad, not reaching below eye, and lower jaw protruding little in front. Teeth strong, in bands in jaws. Tongue broad, rounded convexly in front. Infrorbital very narrow bony ridge. Gill openings lateral, vertical slit before pectoral base. Muzzle and wider

surface of head naked, rest with small cycloid scales. Small cycloid scales crowded before dorsal forward to eyes, becoming large and coarsely ctenoid on tail. Very small cycloid scales on breast and belly. Muzzle with numerous short skinny flaps, and various rows of papillae on sides and upper surface of head. Vent with conic papilla. Two dorsals, first with 6 short flexible spines, second with spine and 10 rays. Anal with spine and 7 graduated rays. Caudal greater than head, ends in long median point behind. Pectoral long, reaches well beyond front of second dorsal or anal. Ventrals separated, little shorter than head.

Known by its variegated coloration, handsome mottling, long caudal fin, robust body, depressed head and trunk, and large eye.

Herre has described *Gobiomorphus illotus* from a specimen but 29 mm long from Polillo. This is surely not congeneric with Gill's *Gobiomorphus*, restricted to large species from New Zealand and apparently not at all like *G. illotus*. Possibly it may enter the present genus, though the large predorsal scales, different facies of the head shown with the interorbital elevated, lack of skinny flaps on the muzzle, greatly shorter fins, and lack of a greatly variegated color pattern seem to preclude the suggestion.

(*Batrachus*, a genus of toad fishes, or Batrachoididae, which these fishes superficially suggest + *Eleotris*.)

**BATRACHELEOTRIS SCLATERI (Steindachner)**

*Eleotris sclateri* STEINDACHNER, Sitz.-Ber. Akad. Wiss. Wien, math.-nat. Classe, vol. 80, pt. 1 (1879), p. 157, 1880 (type locality, Society Islands).

Depth  $4\frac{7}{8}$  to  $5\frac{1}{4}$ ; head 3 to  $3\frac{3}{5}$ , width  $1\frac{1}{5}$  to  $1\frac{1}{2}$ . Snout  $3\frac{3}{4}$  to 4 in head measured from snout tip; eye  $3\frac{4}{5}$  to 4, subequal with snout, greatly exceeds interorbital; maxillary reaches eye, length  $2\frac{4}{5}$  to  $3\frac{1}{2}$  in head from snout tip; teeth simple, pointed, conic, close set, in narrow bands in jaws; interorbital low, narrow, half wide as eye. Gill slit lateral, restricted, equals mouth width.

Scales 33+4 in axial lateral series from suprascapula; 15 transversely above anal origin, 16 to 19 predorsal forward opposite hind eye edge, 7 rows on cheek below eye. Muzzle, interorbital and branchiostegal region naked. Scales much smaller on chest, breast, prepectoral and predorsal regions, largest on tail and caudal peduncle. Scales with 24 to 32 radiating striae; apical denticles large, uniserial, only on scales of tail; circuli coarse on anterior or small scales, larger scales with fine circuli which obsolete apically.

D. VI-I, 10, 1, spines flexible with third 2 in total head, first branched ray  $1\frac{7}{8}$  to 2; A. I, 7, 1, seventh ray  $1\frac{1}{4}$  to  $1\frac{4}{5}$ ; least depth of caudal peduncle  $2\frac{1}{5}$  to  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{10}$  in total head to 3 in fish

without caudal; caudal  $1\frac{1}{3}$  in total head to  $2\frac{1}{3}$  in rest of fish; ventral  $1\frac{1}{3}$  to  $1\frac{1}{3}$  in total head. Anal papilla  $1\frac{1}{3}$  in eye.

Brown, paler to whitish on under surface of head and belly. Cheek or side of head below eye mottled with pearl white and russet, or burnt umber. Warm-brown band transversely from one pectoral base to the other, another darker and more contrasted band from base of spinous dorsal, two from soft dorsal and one on side of caudal peduncle. Whole upper surfaces more or less mottled with pearly and deep brown. Iris gray with pearl and brown tints. Fins largely gray or white, spinous dorsal with blackish brown median blotch, two large ones on soft dorsal, and other fins with rather numerous blackish brown blotches. In small examples fins all more whitish, with blotches paler or brownish, or forming several dark transverse bands on caudal and paired fins. Head usually with some small blackish brown specks or dots. Usually dark brown preorbital bar, which may be reflected across the mandible.

Philippines, East Indies. A very pleasing little fish, with attractive coloration. The following specimens in the Philippine material:

Two examples. Batan Island, tide pools. June 5, 1909. Length 36 to 48 mm.

Five examples. Batan Island, tide pools. July 22, 1909. Length 31 to 47 mm.

Four examples. Canimo Island, near Daet, tide pool. June 15, 1909. Length 37 to 51 mm.

Seven examples. Great Tobea Island, December 15, 1909. Length 25 to 56 mm.

Five examples. Gubat Bay, tide pool. June 23, 1909. Length 33 to 47 mm. (1690.)

Four examples. Mahinog, Camiguin Island, tide pools. August 3, 1909. Length 35 to 44 mm.

Six examples. Nasipit, Mindanao, tide pools. August 1, 1909. Length 16 to 22 mm.

One example. Simaluc Sibi Sibi Island, tide pools. September 23, 1909. Length 52 mm.

One example. Tomahu Island. December 12, 1909. Length 37 mm.

### Subfamily VALENCIENNEINAE

#### NEMATELEOTRIS, new genus

*Type.*—*Nemateleotris magnificus*, new species.

Body elongate, well compressed. Head small, compressed, greatly shorter than trunk. Snout very short, obtuse. Eye large, greatly exceeds snout or muzzle, well advanced in head, impinging on upper profile of head. Mouth moderate, terminally superior or with mandible little protruded in front. Teeth uniserial, large, simple, well spaced. Maxillary oblique, extends below eye. Interorbital rather broad. Head unarmed, without spines. Gill opening lateral, oblique,

rather close before pectoral. Scales present on trunk and tail, very small on predorsal, chest and breast, large on prepectoral and on tail posteriorly. Two dorsals, first of 6 slender spines of which first prolonged as filament, which would reach base of last dorsal ray, and soft fin with spine and 28 rays. Anal little shorter than soft dorsal, with spine and 24 rays. Caudal rather large, ends posteriorly in median point (now damaged). Pectoral short, low. Ventrals well separated, inserted little before pectoral base, slender, moderate.

I name this genus for an exquisite little eleotrid, with its second and third dorsal spines ending in a prolonged filament; peculiar facies of head with very short snout, large eye and strong jaws, and long soft dorsal and anal; also a color pattern of greatly pleasing and contrasted design.

(*νημα*, thread + *Eleotris*; with reference to the elongated, filamentous, first dorsal spine.)

**NEMATELEOTRIS MAGNIFICUS**, new species

Depth 5; head  $4\frac{1}{4}$ , width 2. Snout 5 in head from snout tip; eye 3, greatly exceeds snout, equals interorbital; maxillary extends below first third of eye, length  $2\frac{1}{2}$  in head from snout tip; teeth strong, conic, sharp pointed, about 20 in each jaw; interorbital 3, low, depressed concavely. Gill opening restricted, lateral, length  $2\frac{3}{8}$  in head from snout tip, with rather broad isthmus exposed.

Scales  $108+10$  in axial lateral series; 27 transversely above anal origin. Scales very small and crowded on front sides of back, chest, breast and belly. Caudal base scaly, otherwise fins naked. Scales with 11 basal radiating striae; 8 to 12 rather large uniserial apical denticles; circuli fine, obsolete apically.

D. VI-I, 28, 1, first spine prolonged filament so as to reach base of last ray, fifth ray  $1\frac{1}{3}$  in total head length; A. I, 24, 1, eighth ray  $1\frac{4}{5}$ ; caudal  $3\frac{1}{3}$  in rest of fish, ends posteriorly in median point (damaged): pectoral  $1\frac{1}{10}$  in total head length, rays 17; ventral rays I, 5, fin 1 in total head length; least depth of caudal peduncle  $1\frac{3}{4}$ .

Light brown generally, little paler to whitish on under surface of head and belly. Iris gray-white. Dorsals and anals largely whitish, long filament grayish. Soft dorsal with broad upper border gray black, little above middle each membrane with large black blotch, convex above and concave below so white of fin forms more or less of ocellate appearance, also each membrane with basal whitish area with 3 to 6 small dark gray round spots. Anal with lower border gray black and then band made up of black ocellate spot on each membrane. Caudal pale basally, blackish above and below, and oblique black bar converging medially behind on each lobe. Paired fins dull brown.

The diagnosis is contained in the generic account.

*Type*.—U.S.N.M. no. 99044. (2060.) Buka Buka Island, Gulf of Tomini, Celebes, Dutch East Indies. November 20, 1909. Length 61 mm.

(*magnificus*, splendid.)

#### PTEROCULIOPS, new genus

*Type*.—*Pteroculiops guttatus*, new species.

Body moderately long, well compressed. Head moderate, well compressed, longer than trunk. Muzzle short, broad, declivous. Eye elevated, and advanced in head. Mouth rather large, extends well below eye, mandible little protruded. Lips rather broad, fleshy. Tongue rounded in front. Teeth in narrow band above, uniserial below, and each jaw with canines as 2 pairs above and single wide set lower pair. Interorbital narrow bony frenum. Gill opening moderate, extends forward about opposite hind preopercle edge. Gill rakers lanceolate, short, few. Scales extend forward halfway in predorsal, when obsolete, head otherwise naked. Scales on body finely ctenoid, very small on trunk, breast and belly and become larger on tail, especially posteriorly. Dorsals two, first of 6 flexible spines, second with spine and 11 rays. Anal with spine and 12 rays. Caudal long as ventral, or both longer than head. Pectoral little shorter.

Distinguished chiefly by its very long ventrals, naked head, and coloration with scattered blue-gray round spots, also transverse dark diffuse band across chest and another across middle of belly. It appears allied with *Valenciennia* in the presence of canines, though with much larger scales (about 54).

(πτερόν, fin + *Culius* + ψ, appearance.)

#### PTEROCULIOPS GUTTATUS, new species

Depth 4; head 3, width 2. Snout  $4\frac{7}{8}$  in head from snout tip; eye 4, greater than snout, greatly exceeds interorbital; maxillary extends  $\frac{3}{4}$  in eye, length  $2\frac{1}{10}$  in head from snout tip; lips thick and fleshy; teeth strong, canines bent back, lower pair lateral as one on each mandibular ramus medially; interorbital narrow, low, width  $\frac{1}{4}$  of eye. Gill rakers 5+11, lanceolate,  $\frac{3}{4}$  of gill filaments or 3 in eye.

Scales 64+5 in axial lateral series; 19 above anal origin transversely, 19 predorsal forward opposite hind preopercle edge. Head naked. Scales with 9 to 11 basal radiating striae; 11 apical denticles, rather large, uniserial; circuli fine.

D. VI-I, 11, 1, fourth spine  $1\frac{3}{4}$  in total head length, first branched ray 2; A. I, 12, 1, first branched ray  $2\frac{2}{3}$ ; caudal 3 in rest of fish, ends in median point behind; least depth of caudal peduncle  $2\frac{7}{8}$  in total head length; pectoral  $1\frac{1}{6}$ , rays 20; ventral rays I, 5, fin 1 in total head length.

Brown, little paler below. Chest, branchiostegal region, and isthmus dark chocolate, also a broad chocolate band transversely across middle of postventral region, up each side level with pectoral fin. Iris silvery gray. Head and body with many variable, mostly large rounded blue-gray spots, more or less ringed with darker brown. Fins all pale gray brown, anal dark brown terminally, and both soft dorsal and anal with 4 basal blue-gray large spots. Pectoral pale yellowish brown. Ventral gray brown outside, gray black inside or toward belly.

Diagnosis included in that of the genus. Only the type known.

*Type*.—U.S.N.M. no. 99045. (1169.) Port Banalakan, Marinduque Island. February 23, 1909. Length 69 mm.

(*guttatus*, spotted.)

### POGONOCULINAE, new subfamily

#### POGONOCULIUS, new genus

*Type*.—*Pogonoculius zebra*, new species.

Body elongate, greatly compressed. Head small, short, compressed. Snout short, obtuse. Eye moderate, well advanced and high in head. Mouth terminally superior, subvertical. Mandibular bones well separated, protrude before snout, interspace of chin deep, with median free tentacle nearly long as combined snout and eye, and followed by dermal ridge to isthmus. Teeth large, simple, uniserial. Gill openings lateral. Body largely scaled, small irregular scales only distinct on tail posteriorly. Two dorsals, spines 6, rays 28. Anal rays 26, fin like second dorsal and opposite. Caudal peduncle short, free. Caudal moderate, truncate. Pectoral short, rounded, with broad base. Ventrals close, distinctly separated and much longer than pectorals. Vent close before anal.

Unique in the mental tentacle and combination of structural characters, such as the small head, long ventrals, strong dentition, long second dorsal and anal, etc. It is perhaps related to *Ptereleotris* Gill, differing sharply in the characters noted above, especially its obsolete lepidosis, coloration, general appearance, and other characters.

(πώγων, beard + *Culius*, an old name for *Eleotris*.)

#### POGONOCULIUS ZEBRA, new species

Depth  $5\frac{1}{3}$ ; head  $4\frac{3}{4}$ , width  $1\frac{3}{4}$ . Snout 5 in head from snout tip; eye 4, greater than snout, equals interorbital; maxillary subvertical, reaches  $\frac{4}{5}$  to eye, length 3 in head from snout tip; teeth conic, large, well spaced, sharp pointed, 10 in each jaw, none on palate; interorbital

$3\frac{3}{5}$  in head from snout tip, low, convex. Gill opening restricted, leave moderately narrow isthmus.

Scales minute, nonimbricate, rounded, imperfectly developed, or only on tail where more numerous posteriorly.

D. VI-28, 1, last spine  $1\frac{2}{3}$  in total head length, first ray  $1\frac{3}{4}$ ; A. 26, 1, second ray  $1\frac{3}{4}$ ; caudal 1, truncate; least depth of caudal peduncle 2; pectoral  $1\frac{1}{8}$ , rays 23; ventral I, 4, fin 1 in head.

Brown, scarcely paler below, with 21 narrow pale brown transverse bands, narrower than dark interspaces, and each with dark brown bordering line. Iris grayish. Fins all light brown like general body color, only upper edge of both dorsals narrowly black with submarginal gray line. Broad pale brown transverse band on pectoral base, its front and hind margins each with dark brown bordering line.

Diagnosis contained in the description of the genus.

*Type*.—U.S.N.M. no. 99048. (1535.) Dasol Bay. May 8, 1909. Length 95 mm.

(*zebra*, with reference to the striped appearance.)







SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1938

No. 3033

## EVIDENCE OF TRIASSIC INSECTS IN THE PETRIFIED FOREST NATIONAL MONUMENT, ARIZONA

By M. V. WALKER

IN MY nature notes for May 1935, I described for the first time some peculiar markings that occur on many of the petrified logs in the Petrified Forest National Monument, Ariz. It was thought that these were made by some form of insect (larvae) that had attacked the trees, and for purposes of identification they were described and named. Some time later Dr. Junius Henderson visited the Petrified Forest National Monument Museum, and his attention was called to these markings. He at once suggested that the material be assembled for publication, and accordingly I prepared the present descriptive article.

At first I was unable to find descriptive literature concerning such occurrences, but in October 1936 an article appeared in the *Journal of Paleontology* by Dr. Charles T. Brues, of Harvard University, entitled "Evidence of Insect Activity Preserved in Fossil Wood." I was greatly interested in this descriptive material and am now more convinced than ever that several types of "borings" may eventually be described from the petrified wood of the Petrified Forest National Monument. Dr. Brues had only a few specimens available for study, but we have, in the logs of the Petrified Forest region, literally thousands of specimens of this nature. Surely a trained observer would not lack for study material for a research problem in the Petrified Forest National Monument. It is hoped that this

paper will serve its purpose by calling attention to the existence of such phenomena and that future research workers will recognize that this area is worth a careful investigation. Plate 1 shows a map of the region and the localities where types were taken.

#### LARVAL TRAILS IN THE PETRIFIED WOOD

On many of the fossil trees in the Petrified Forest National Monument there are peculiar ridges and shallow channels, some of which completely encircle the massive trunks. To the average observer these are just "funny" marks on the trees, but when examined carefully they seem to indicate that they were made by some form of animal life. The more they are studied the more I am convinced that they were made by some insect (larvae) that had attacked the forest. These ridges, channels, and tunnels apparently represent the burrows and cuttings of the larvae of wood borers or bark beetles.

Two different groups are recognized; one is represented by channels that were apparently just under the bark; the other by tunnels or burrows cut through the heart-wood, some around the outside of the tree but sometimes penetrating 40 or 50 cm from the outside, while others bored through and through the wood in all directions.

Several "species" of each group seem to be present. In order to distinguish these different forms, the following method of classification and description has been adopted:

#### GROUP 1

This group consists of channels, not tunnels, that for the most part occur apparently just under the bark. The cuttings evidently are coming partly from the heart-wood. In some cases the cuttings were silicified and now form raised bands around the tree trunks. In some others the cuttings dropped out, leaving shallow channels. In this group there are three species, as follows:

#### *PALEOBUPRESTIS MAXIMA*, new genus and species

#### PLATE 2

*Type specimen*.—U.S.N.M. no. 95870.

*Referred specimen*.—Petrified Forest Nat. Mon. Mus. no. 101.

*Type locality*.—Petrified Forest National Monument, Holbrook, Ariz.

*Formation*.—Triassic (Chinle).

*Description*.—These channels seem to occur just under the bark. They measure about 10 mm across and may be followed completely around the tree; in some instances channels measure from 1 to 2 meters in length. The cuttings made by the larva as it worked along show exceptionally well. Where the cuttings were silicified in

place they now appear as raised bands 3 to 6 mm in thickness. The structure of the castings in the channels is in striking contrast to the normal texture and grain of the wood, which is in nearly all instances at right angles to the channel.

**PALEOBUPRESTIS MINIMA, new species**

**PLATE 3, B**

*Type specimen.*—U.S.N.M. no. 95871.

*Referred specimen.*—Petrified Forest Nat. Mon. Mus. no. 183.

*Type locality.*—Petrified Forest National Monument, Holbrook, Ariz.

*Formation.*—Triassic (Chinle).

*Description.*—These small channels measure only about 2 mm in diameter. None of them can be traced more than a few centimeters. It appears, however, as if some of them had completely encircled the small trunk. Some of the castings were silicified and appear as raised bands, while others dropped out and the work is preserved only as shallow channels. The castings in the channels are in striking contrast to the normal texture of the wood.

**PALEOSCOLYTUS DIVERGUS, new genus and species**

**PLATE 3, A**

*Type specimen.*—U.S.N.M. no. 95872.

*Referred specimen.*—Petrified Forest Nat. Mon. Mus. no. 184.

*Type locality.*—Petrified Forest National Monument, Holbrook, Ariz.

*Formation.*—Triassic (Chinle).

*Description.*—These channels occur just under the bark. They measure only about 5 mm across but are not filled with the castings. The cuttings apparently fell out before being silicified. These channels do not as a rule go around the tree but run in all directions, and consequently they appear very much like the workings of our modern bark beetles or engraver beetles of the family Scolytidae. The best channels of this species are found on some of the trees in the Black Forest of the Painted Desert section.

**GROUP 2**

This group includes tunnels and burrows, not channels, that penetrate the heart-wood. Some occur near the bark and seem to go around the log, while others seem to have bored through and through the wood. The cuttings in the tunnels have been completely silicified and agatized, but the tunnels are in striking contrast to the natural texture of the silicified and agatized wood. In this group there are two species, named as follows:

## PALEOIPIDUS PERFORATUS, new genus and species

## PLATE 4, B

*Type specimen*.—U.S.N.M. no. 95873.

*Referred specimen*.—Petrified Forest Nat. Mon. Mus. no. 185.

*Type locality*.—Petrified Forest National Monument, Holbrook Ariz.

*Formation*.—Triassic (Chinle).

*Description*.—These tunnels seem to go through and through the wood. They measure about 5 mm in diameter but appear to be angular rather than round. In some cases they are exposed by decay or weathering of the wood, and they appear square to rectangular in outline. Cross sections viewed in the solid matrix appear oval in outline but with a flattened surface on one side; the silicified cuttings are in striking contrast to the normal texture of the wood.

## PALEOIPIDUS MARGINATUS, new species

## PLATE 4, A

*Type specimen*.—U.S.N.M. no. 95874.

*Referred specimen*.—Petrified Forest Nat. Mon. Mus. no. 102.

*Type locality*.—Petrified Forest National Monument, Holbrook, Ariz.

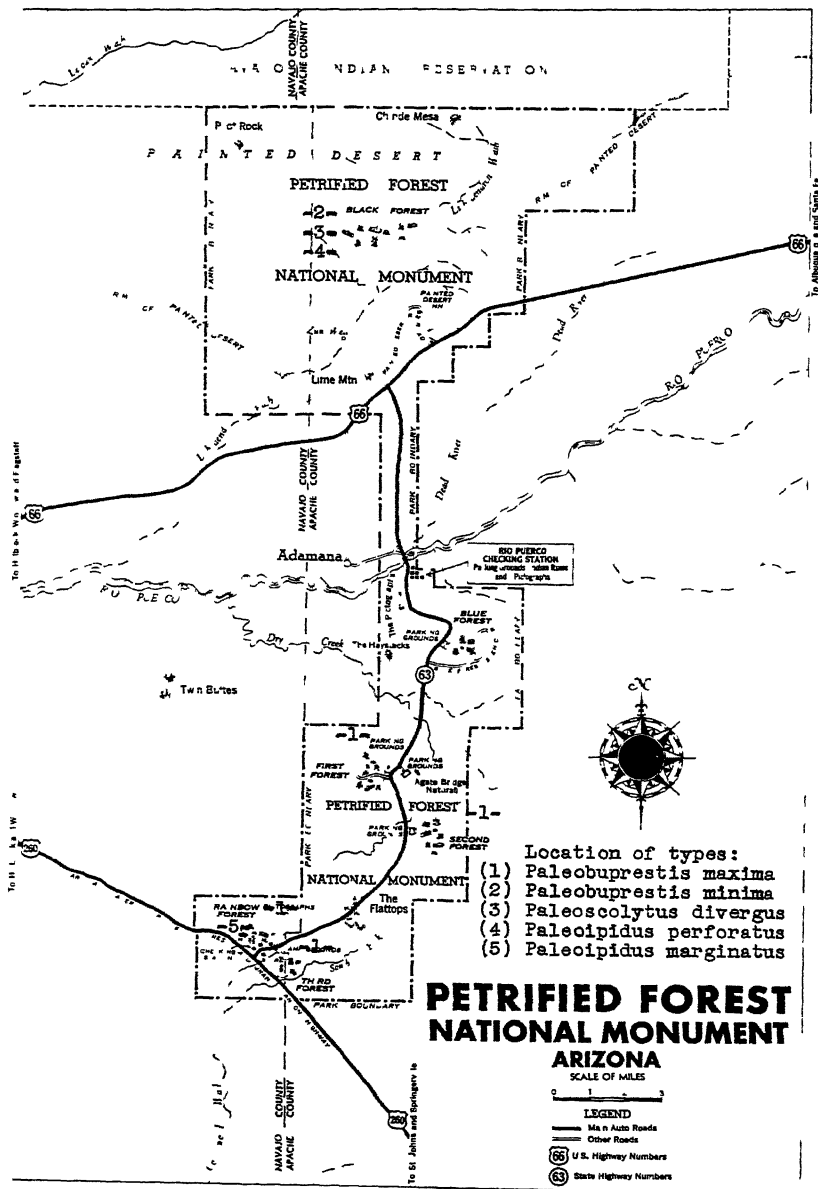
*Formation*.—Triassic (Chinle).

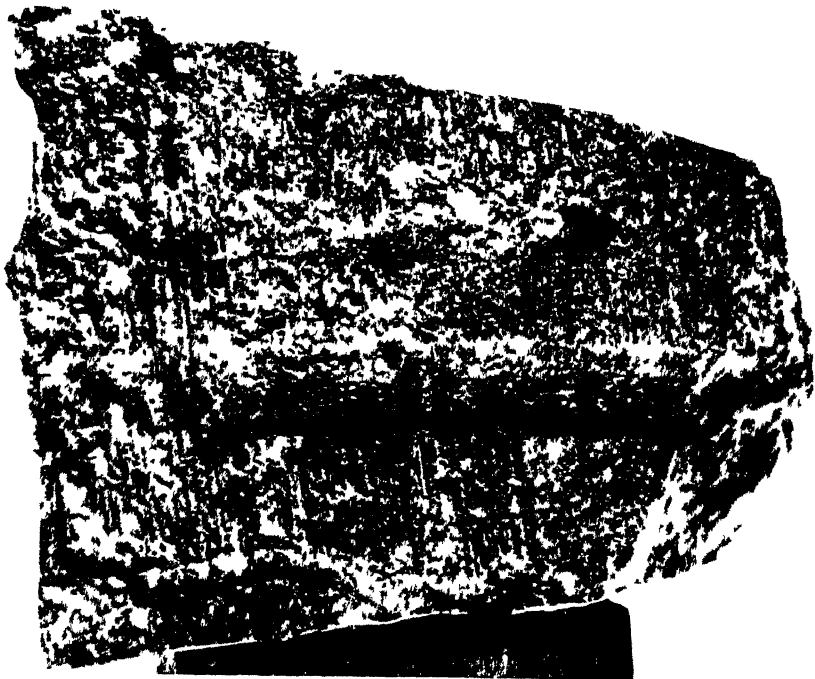
*Description*.—These tunnels that occur in the heart-wood may be observed only in a few polished sections on exhibit in the museum. Tunnels of two sizes are recognized, one measuring about 2 mm, the other 3 mm, in diameter. In the few complete log sections where these tunnels have been observed, they never penetrate more than 10 or 20 cm from the margin or probable bark layer. The castings have been completely agatized but may be easily traced across a polished surface.

## SUMMARY

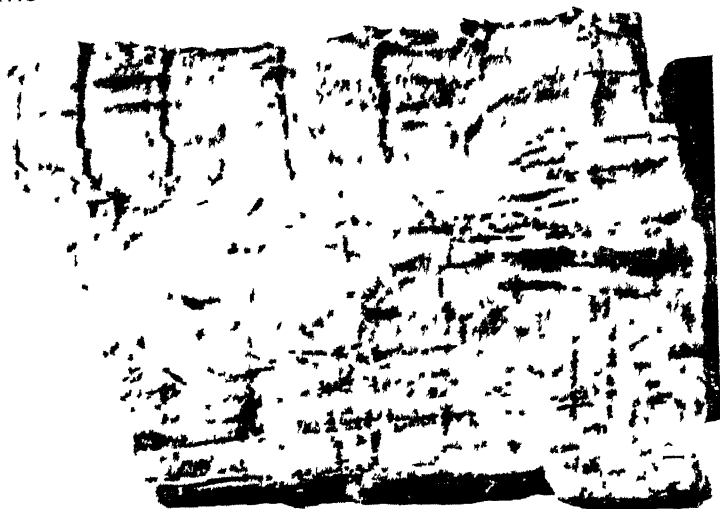
As far as I have been able to observe, the only species of tree attacked by the borers is *Araucarioxylon arizonicum*. In no instance has there been found evidence of insect activity in either *Woodworthia* or *Schilderia*, the other two known genera of fossil trees from the Petrified Forest National Monument area.

The large channels of Group 1 resemble somewhat the work of some modern buprestids, and it seems logical to believe that many of the trees were girdled and killed. In that way one might account for such a concentration of logs as occurs at about the 300-foot level in the Chinle of this region, where it is estimated that approximately 50 percent of the log sections show evidence of being attacked by these borers.



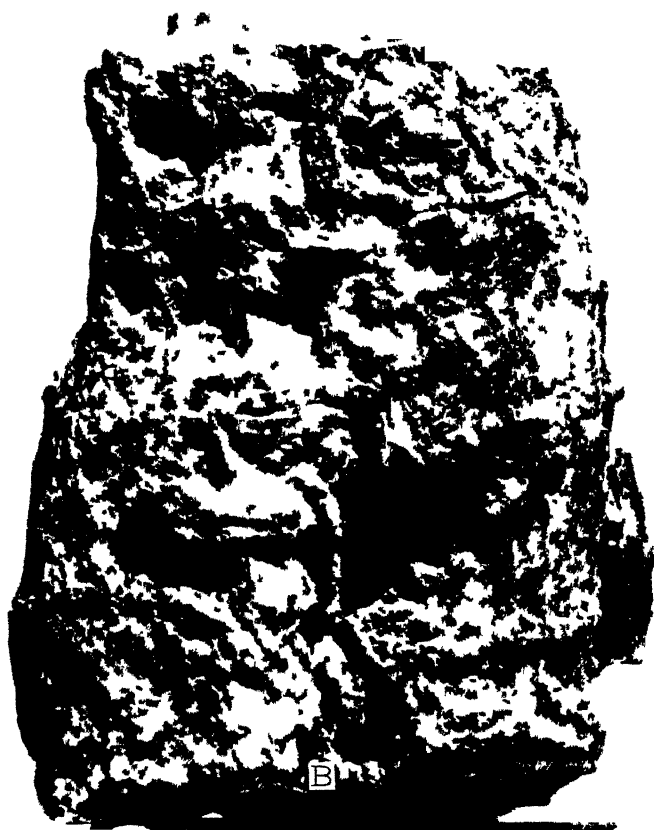
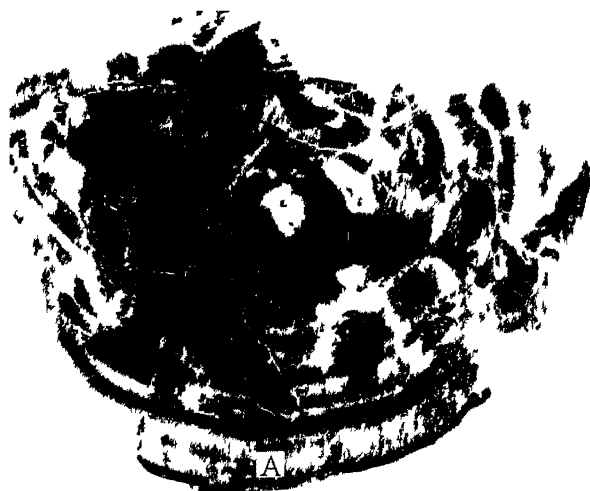


EVIDENCE OF TRIASSIC INSECTS *PALEOBUPRESTIS MAXIMA* NEW GENUS AND SPECIES



EVIDENCE OF TRIASSIC INSECTS (A) *PALLOSCOLYTUS DIVERGUS* NEW GENUS AND SPECIES (B) *PALEOBUPRESTIS MINIMA*  
NEW GENUS AND SPECIES





EVIDENCE OF TRIASSIC INSECTS A PALEOIPIDUS MARGINATUS NEW GENUS  
AND SPECIES (B) PALEOIPIDUS PERFORATUS NEW SPECIES

Whether the heart-wood borers of Group 2 attacked only the dead trees cannot be determined, since no specimens have been found showing the workings of both groups on the same log section.

Recent discoveries of beautifully preserved leaves of ferns and cycads lead one to believe that there is a possibility of someday finding fossil insect remains in these remarkable, fine-grained, paper shales of the Chinle.

Numerous questions will undoubtedly arise in the minds of many regarding these very brief generalizations. It may be mentioned, however, that the Coleoptera are recorded as far back as the Triassic, and they were numerous in the Jurassic formation. Since we know that the buprestids date back many geological periods, it seems logical to believe that some form of larva or borer could have infested the trees of the great Triassic forests.

There are numerous trails on the thin, fine-grained sandstones and flagstones of the Petrified Forest area that appear to have been made by some arthropod, but there is no reason for assuming that these trails were made by the adult beetles whose larvae worked the burrows in the trees.

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SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1938

No. 3034

## REVIEW OF THE ANNELID WORMS OF THE FAMILY NEPHTYIDAE FROM THE NORTHEAST PACIFIC, WITH DESCRIPTIONS OF FIVE NEW SPECIES

By OLGA HARTMAN

THE NEPHTYIDAE of the northeast Pacific are known to be represented by a single genus, *Nephtys* Cuvier. Five species of *Nephtys* have been reported from California, all of them typically polar Atlantic or circumpolar forms, with type localities as follows: *N. caeca* (Fabricius), Greenland; *N. ciliata* (O. F. Müller), Norway; *N. assimilis* Malmgren, Norway; *N. incisa* Malmgren, Norway; and *N. malmgreni* Théel, Novaya Zemlya. Thus, even at first glance, it is evident that the records for California should be examined critically. Probably only one of these species, *N. caeca*, is present in California, and that one seemingly rare; whereas two others, *N. ciliata* and *N. malmgreni*, are present in more northern Pacific waters. Doubts as to the identifications of *N. caeca* have already been expressed (Moore, 1909 and 1911; Monro, 1933; and others). In some cases differences have been described that have made it possible to identify the specimens in question with species treated herein.

*Materials used.*—Through the courtesy of the United States National Museum, its entire collection of west coast Nephtyidae was placed at my disposal. This collection contains most of the species herein treated. In addition, there were numerous collections in the zoology department of the University of California, chiefly from southern California. Others, made by E. F. Ricketts from Alaska and Puget Sound, were of great help. Still others, collected during

the past four years by members of the classes of invertebrate zoology of the University of California, were obtained chiefly from the littoral zones of northern California. These collections have permitted the examination of several hundred individuals.

*Acknowledgments.*—I wish to express appreciation particularly to Dr. Waldo L. Schmitt, of the United States National Museum, and to E. F. Ricketts, of Pacific Grove, Calif., for making available many of the collections used; also to C. C. A. Monro, of the British Museum, for labeled collections of European species of *Nephtys*.

Holotypes of new species are deposited in the United States National Museum; paratypes in the University of California.

*Terminology.*—*Recurved cirrus* is herein used to designate the ventral outgrowth of the dorsal cirrus (=branchia or branchial cirrus of some authors). *Terminal bifid papillae* are the distal, bifurcated outgrowths of the dorsal and ventral lips of the proboscis; the *median dorsal papilla* (when present) is the more or less elongate, unpaired papilla inserted between the terminal and subterminal papillae. The wartlike or hooklike elevations sometimes present on the proximal portion of the proboscis [höckerartigen Papillen of Ehlers (1868, p. 624)] are not designated papillae, since they bear no resemblance to the so-called more distal outgrowths.

SPECIES OF NEPHTYS FROM THE NORTHEAST PACIFIC, WITH KNOWN  
DISTRIBUTION

1. *Nephtys caeca* (FABRICIUS): Circumpolar; northeast Pacific south to central California (rare).  
*Nereis caeca* FABRICIUS, 1780, p. 304 (Greenland).  
*Nephtys caeca* EHLERS, 1864-68, p. 588 (Gulf of Georgia).—JOHNSON, 1910, p. 401 (part) (Alaska, Puget Sound).—MOORE, 1908, p. 341 (Alaska).—TREADWELL, 1914, p. 192 (part); 1926, p. 4 (Alaska).—CHAMBERLIN, 1919, p. 255 (Gulf of Georgia).—BERKELEY, 1924, p. 290 (British Columbia).  
non MOORE, 1909, p. 243; 1911, p. 243; 1923, p. 257.—HILTON, 1919, p. 27 (?).
2. *Nephtys ciliata* (O. F. MÜLLER): Circumpolar.  
*Nereis ciliata* MÜLLER, 1789, p. 14 (Norway).  
*Nephtys ciliata* MOORE, 1908, p. 341 (Alaska).—CHAMBERLIN, 1920, p. 9B (north circumpolar).—BERKELEY, 1924, p. 290 (British Columbia).  
? non BERKELEY, 1935, p. 770 (Elkhorn Slough, Calif.).
3. *Nephtys dibranchis* GRUBE: Tropical and subtropical Pacific.  
(See p. 146 for distribution details.)
4. *Nephtys magellanica* AUGENER: Southeastern Pacific north to San Diego Bay.  
(See p. 146 for distribution details.)
5. *Nephtys malmgreni* THÉEL: Behm Canal, Alaska: Circumpolar.  
THÉEL, 1879, p. 26 (Novaya Zemlya).—MOORE, 1908, p. 342 (Alaska, dredged).—? TREADWELL, 1914, p. 192 (southern California).
6. *Nephtys caecoides*, new species: California (littoral); Lower California; Washington (rare).

7. *Nephtys californiensis*, new species: California (littoral to 20 fathoms).
8. *Nephtys schmitti*, new species: Northeast Pacific (dredged).
9. *Nephtys rickettsi*, new species: Northeast Pacific.
10. *Nephtys punctata*, new species: Alaska south to Monterey Bay.

## KEY TO THE SPECIES OF NEPHTYS FROM THE NORTHEAST PACIFIC

1. Recurved cirri involute..... 2  
     Recurved cirri not involute, some curved outward (fig. 63, *g*)..... 3
2. Recurved cirri developed at fourth or fifth setiger; proboscis distally with 22 rows of papillae; lyre setae present; neuropodium with a slender, superior lobe..... *dibranchis*  
     Recurved cirri first developed after tenth setiger; proboscis distally with 14 rows of papillae; lyre setae absent; neuropodium without superior lobe..... *malmgreni*
3. Recurved cirri flattened, foliaceous between segments 14 to 35 (fig. 65, *c*); proboscis proximally smooth..... *schmitti*  
     Recurved cirri cirriform or thickened, not foliaceous..... 4
4. Recurved cirri thick, blunt, digitate in postmedial region (fig. 66, *c*); proboscis proximally obsoletely wartlike; postsetal lobes thick, fleshy, well developed in median region (fig. 66, *b*)..... *rickettsi*  
     Recurved cirri cirriform or sickle-shaped (fig. 63, *g*)..... 5
5. Recurved cirri present from tenth or eleventh setiger, absent from posterior fifth of body; proboscis proximally covered with minute, conical, chitinous prickles..... *punctata*  
     Recurved cirri present from third or fifth setiger to posterior end..... 6
6. Neuropodial acicular lobe bluntly conical or rounded (fig. 62, *c, d*)..... *magellanica*  
     Neuropodial acicular lobe bilobed (fig. 63, *g*)..... 7
7. Proboscis proximally smooth, glistening..... 9  
     Proboscis proximally covered with low, coarse, wartlike processes or minute conelike elevations..... 8
8. Proboscis with a median dorsal papilla; recurved cirri reduced on last 20 or 30 setigers; postsetal lamellae not conspicuous..... *ciliata*  
     Proboscis without median dorsal papilla; recurved cirri present to posterior end; postsetal lamellae large, thin, foliaceous..... *caeca*
9. Proboscis with median dorsal papilla; recurved cirrus present from fourth setiger; setae stiff, dusky, held stiffly from side of body..... *caecoides*  
     Proboscis usually without a median dorsal papilla; recurved cirrus present from third setiger; setae soft, silky, flowing..... *californiensis*

## Genus NEPHTYS Cuvier

*Nephtys* CUVIER, 1817, p. 173.

*Nephtys* SAVIGNY, 1822, p. 12.

The spelling *Nephtys* is used herein in place of the more widely used *Nephtys* because the former has priority. Cuvier erected the genus for the species *N. hombergi*. In his table of contents (p. xxviii) he also spelled the name *Nephtis*.

## NEPHTYS DIBRANCHIS Grube

*Nephtys dibranchis* GRUBE, 1878, p. 536.—MCINTOSH, 1885, p. 161 (New Guinea).—AUGENER, 1922, p. 17 (Ecuador, New Zealand).—MONRO, 1933, p. 56 (Gorgona Island).

?*Nephtys mirasetis* HOAGLAND, 1920, p. 610 (Philippine Islands).

Parapodial arrangement agreeing with that described by Augener (1922) and Monro (1933). Proboscis provided with 22 rows of papillae as described by Monro, 7 or 8 papillae in each row. Entire proboscis minutely and closely covered with prickles. Readily distinguished by its involute recurved cirri, its lyre setae, and the type of structure of the presetal and postsetal lamellae.

Numerous specimens from *Albatross* station 2838 (1888), off Lower California, in 44 fathoms. This is the northernmost record for *N. dibranchis*. Its range is hereby extended to include probably also the Philippine Islands (Hoagland).

*Discussion*.—Monro (1933, p. 56) has already commented on the discrepancies in the descriptions of *N. dibranchis* as given by McIntosh (1885, pp. 161, 163) and Augener (1922, p. 18) and of individuals he described from Gorgona Island. The description of *N. mirasetis* Hoagland (1920, p. 610) presents other difficulties in that lyre setae were not described for it. These may have been overlooked. Its proboscis has 22 rows of papillae (Hoagland, pl. 48, fig. 5), agreeing therein with the individuals described from Gorgona Island and Lower California. The parapodial arrangement of *N. mirasetis* (pl. 48, fig. 6) agrees well with that for *N. dibranchis* Grube.

## NEPHTYS MAGELLANICA Augener

## FIGURE 62

*Nephtys magellanica* AUGENER, 1912, p. 208.

*Nephtys cirrosa* var. EHLEBS, 1901, p. 67 (*non* Ehlers, 1864-68, p. 624) and *N. longosetosa* Ehlers, 1901, p. 67 (*non* Ørsted, 1843, p. 195). (*Fide* Augener, 1912, p. 208.)

*Nephtys incisæ* TREADWELL, 1914, p. 193. (*Non* Malmgren, 1865, p. 105.)

*Additional description*.—Length to 100 mm; number of segments 120-150. Prostomium as in figure 62, *a*. Recurved cirri present from third setiger, these never long (fig. 62, *b-d*), at most extending to near middle of parapodia, and only slightly curved outward. Median dorsal papilla of proboscis similar to the larger paired subterminal papillae. Proboscis smooth on its proximal part. Setae long, silky, somewhat flowing or recumbent at sides.

*Distribution*.—San Diego Bay, southern California; the Straits of Magellan and Chile (Augener).

*Discussion*.—Augener (1912, p. 210) indicated the affinities of *N. magellanica* with *N. cirrosa* Ehlers, stating that the former may be

thought of as a geographical, southwest American subspecies of *N. cirrosa*. There are several significant differences between the two species: (1) Recurved cirri are present from the third setiger in *N. magellanica*, from the fourth setiger in *N. cirrosa*; (2) the proboscis is proximally smooth in *N. magellanica*, prickly in *N. cirrosa* (cf. Ehlers, 1868, pl. 23, fig. 6); (3) *N. magellanica* consists of 120 to 150 segments, *N. cirrosa* of 90 to 95 segments.

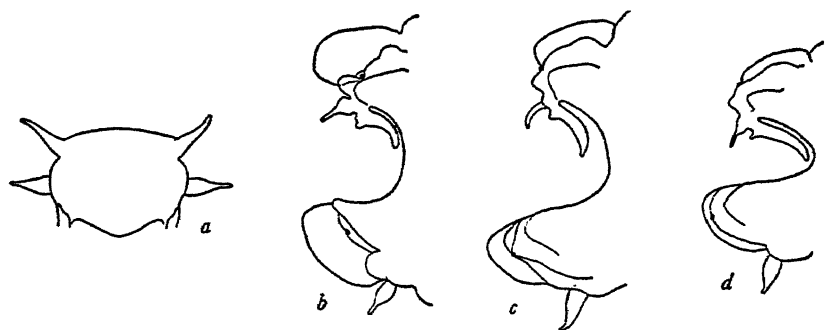


FIGURE 62.—*Nephtys magellanica* Augener: *a*, Outline of dorsal surface of prostomium; *b*, third parapodium in anterior view; *c*, thirty-sixth parapodium in anterior view; *d*, sixtieth parapodium in anterior view.

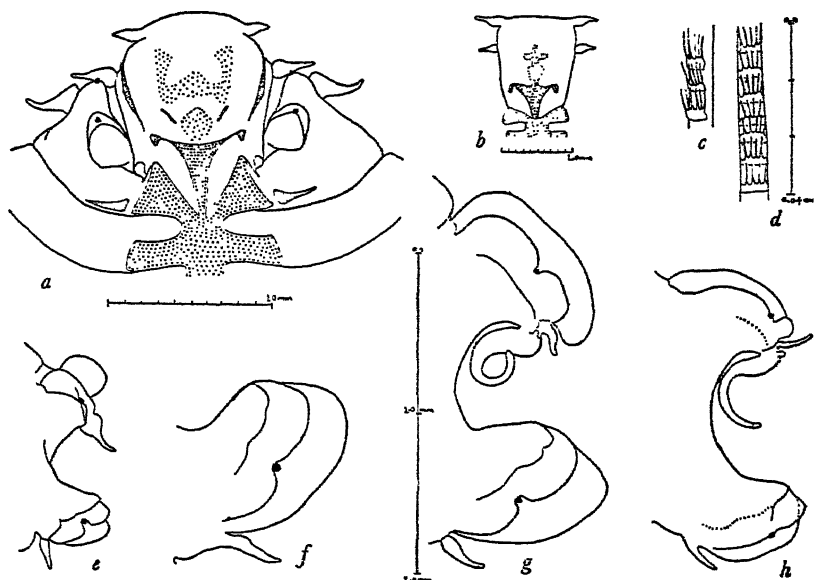


FIGURE 63.—*Nephtys caecoides*, new species: *a*, Prostomium and first segment in dorsal view (from an individual with proboscis protruded); *b*, same, from an individual with proboscis retracted; *c*, portion of a bristled postlamellar seta seen somewhat from the side; *d*, same, in face view; *e*, third parapodium in anterior view; *f*, neuropodium of fiftieth setiger in anterior view; *g*, twenty-fifth parapodium in anterior view; *h*, fifteenth last parapodium in anterior view.



## NEPHTYS CAECOIDES, new species

## FIGURE 63

*Nephtys coeca* JOHNSON, 1901, p. 401 (part).

*Nephtys caeca* MOORE, 1909, p. 243; 1911, p. 243; 1923, p. 257 (part).—?

TREADWELL, 1914, p. 192 (part).—? HILTON, 1919, p. 27. (*Non* Fabricius, 1780, p. 304.)

*Nephtys assimilis* TREADWELL, 1914, p. 193 (part). (*Non* Malmgren, 1865, p. 105.)

?*Nephtys malmgreni* TREADWELL, 1914, p. 192. (*Non* Théel, 1879, p. 26.)

Length to 100 mm; width 5 to 8 mm; number of segments about 120; trim, stiff, slender in appearance.

Prostomium trapezoidal or somewhat rounded anteriorly (fig. 63, *a, b*); with characteristic dusky brown pigmentation pattern in life, persisting through preservation; postectal margins of prostomium with a pair of prominent nuchal papillae (fig. 63, *a*).

Proboscis subdistally with 22 rows of papillae and a median dorsal papilla; proximally smooth, glistening. Recurved cirri first present from fourth setiger, continued posteriorly almost to end of body; fifteenth last segment as in figure 63, *h*. Recurved cirri exceeding their respective dorsal cirri except in last nine segments, where recurved cirri are smaller than dorsal cirri.

Parapodia as in figure 63, *e-h*: dorsal and ventral cirri of first parapodium somewhat flattened triangular (fig. 63, *e*). Setae of three kinds: Slender, barred, in preacicular fascicle; simple, capillary; and bristled, capillary in postacicular fascicle. Bristled area of the latter extensive (fig. 63, *c, d*), extending almost across width of setae where best developed.

*Holotype*.—U.S.N.M. no. 20319.

*Distribution*.—Tomales Bay, Calif. (type); Bodega, Bolinas, San Francisco. Morro, Half Moon and Newport Bays, and Elkhorn Slough, Calif.; Wallochey Bay, Wash. (one individual collected by E. F. Ricketts). Common in muddy sands and eelgrass flats, contrasting therein with the habitat of *N. californiensis* (see below), which abounds in cleaner, coarser sandy beaches. *N. caecoides* seems to replace the polar *N. caeca* (Fabricius) in more temperate waters. In numerous collections studied the latter has been encountered only once from California, the former only once from the north Pacific (Washington).

*Systematic discussion*.—Moore (1911, p. 243) identified numerous individuals from California as *N. caeca*, stating, however, that "scarcely a single specimen can be said to be typical *N. caeca*," and "I am by no means convinced that more than one species may not be represented." Monro (1933, p. 51) described a *Nephtys* sp. as a tropical representative of *N. caeca* but said that it showed certain differences from the typical form. Johnson's *N. coeca* (1901, p. 401)

includes at least two species, *N. caeca*, from Alaska and Puget Sound, and *N. caecoides*, from San Francisco. Johnson designated the California specimens as "pygmies." *N. caecoides* is notably smaller than *N. caeca* (cf. measurements above).

*N. caeca* of Moore (1909, p. 243) includes at least two species, probably *N. caecoides*, from San Diego, represented by "examples of small to medium size and colorless or slightly marked with brown figures and bands on the prostomium and a few anterior segments"; and *N. californiensis*, from Monterey Bay, the latter "much larger . . . prostomium with a brown or black 'spread eagle' . . . free margins of prostomium thin and produced . . . serrated setae forming flowing tufts." *N. caeca* of Moore (1911, p. 243) probably includes these same two species. The two specimens (station 4482, Santa Cruz Light-house) with involute gills may be *N. dibranchis* Grube (see page 146).

Lack of information renders it impossible to ascertain the identity of Hilton's *N. caeca* (1919, p. 27) from Laguna Beach, Calif., and Treadwell's *N. caeca* (1914, p. 192) from "Alaska to Humboldt Bay."

*Comparison of N. caecoides and N. californiensis* (see also page 150).—These two are the only common littoral species of *Nephtys* found in numerous field collections from California. They sometimes occur in the same beaches, almost side by side, but more usually are segregated on the basis of substratum (see page 151). They resemble each other strikingly in (1) trapezoidal outline of the prostomium (compare fig. 63, *a, b*, and fig. 64, *a, b*), (2) the proportions of the acicular lobes (see figs. 63, *j-h* and 64, *j-h*), (3) the bathymetric and geographical ranges (see under distributions).

They are distinguishable by the following characters: (1) Posterior, postsetal, neuropodial lamellae are truncate in *N. californiensis* (fig. 64, *h*), rounded in *N. caecoides* (fig. 63, *h*); (2) recurved cirrus is first present on third setiger in *N. californiensis*, on fourth in *N. caecoides*; (3) the extent of the bristled area of the postacicular setae differs (compare figs. 63, *c, d* and 64, *c, d*); (4) the superior neuropodial lobe closely surrounds the superior setae in *N. caecoides* and is collarlike in *N. californiensis* (fig. 64, *f, g*); (5) the nuchal papillae are conspicuous in *N. caecoides* (fig. 63, *a*), not so in *N. californiensis* (fig. 64, *a*); (6) the first dorsal and ventral cirri are triangular in *N. caecoides*, cirriform in *N. californiensis* (figs. 63, *a*, 64, *a*); (7) proboscis is provided with a median papilla in *N. caecoides* and usually without in *N. californiensis*; (8) setae are soft, silky, recumbent in *N. californiensis*, stiff in *N. caecoides*; (9) *N. caecoides* is usually steel to dark gray in life, *N. californiensis* pearl-gray to pale white; (10) the color patterns of the dorsal surface of the prostomium differ (see figs. 63, *a, b*, and 64, *a, b*); and (11) *N. caecoides* is usually considerably smaller than *N. californiensis* (cf. measurements, pp. 148 and 150).

## NEPHTYS CALIFORNIENSIS, new species

FIGURE 64

*Nephtys caeca* MOORE, 1909, p. 243 (part). (See p. 148 herein.)

?*Nephtys caeca ciliata* BERKELEY, 1935, p. 770.

?*Nephtys assimilis* TREADWELL, 1914, p. 193 (part).

Length 130 to 300 mm; width 6 to 10 mm in anterior third or widest part; number of segments 100 to 160; broad, depressed, tapering gradually posteriorly to a slender, caudal end. Segments marked by faint, segmental lines dorsally and ventrally.

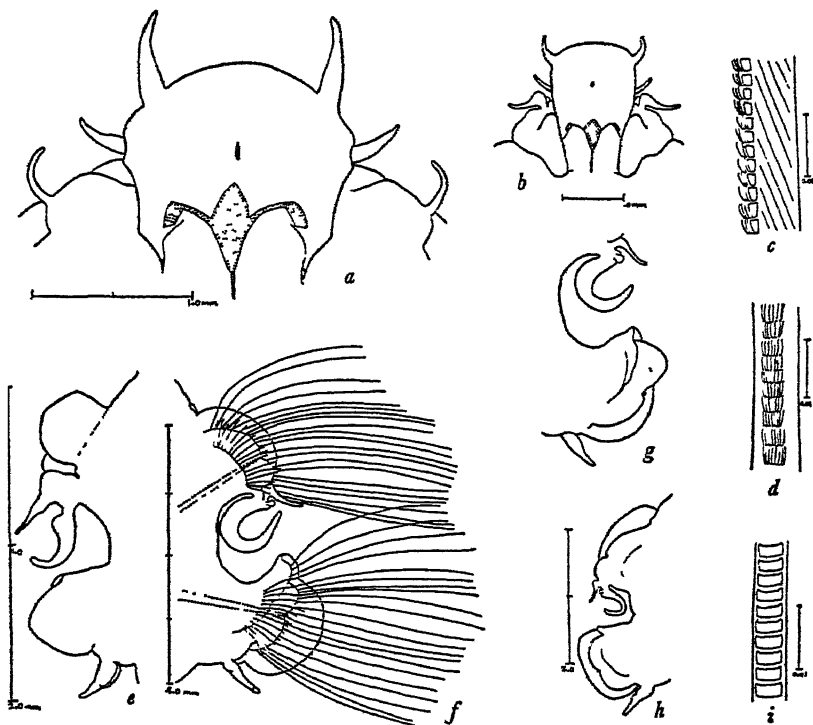


FIGURE 64.—*Nephtys californiensis*, new species. *a*, Prostomium and part of first segment in dorsal view (from an individual with proboscis protruded); *b*, same, from an individual with proboscis retracted; *c*, portion of a bristled, postlamellar seta seen somewhat from the side; *d*, same, in face view; *e*, third parapodium in posterior view; *f*, twenty-fifth parapodium in anterior view (setae diagrammatically represented); *g*, recurved cirrus and neuropodium of seventy-fifth parapodium in anterior view; *h*, a posterior parapodium; *i*, portion of a barred, prelamellar seta.

Prostomium roughly trapezoidal, widest anteriorly (fig. 64, *a*, *b*), anterior margin rounded, spatulate; frontal antennae inserted at widest part of anterior margin. A characteristic pigmented patch on posterior third, what Moore (1909, p. 243) has designated a "spread eagle" (fig. 64, *a*, *b*). Nuchal papillae slitlike, hardly visible.

Proboscis large, clavate, usually without a median papilla (rarely one of the paired papillae seems to occupy a median position); subdistally with 22 rows of papillae, 6 to 8 in a row, the more distal ones about as long as those of the terminal forked set. Proximal portion of proboscis smooth, glistening.

Parapodia well developed throughout; over half as long as body is wide; provided with many silky, flowing setae, directed caudally. Parapodial lamellae distinct. Dorsal and ventral cirri of first parapodium subulate, exceeding in size the frontal antennae; notopodium with lamellae, aciculum, and preacicular and postacicular fascicles of setae; neuropodium with reduced setal fascicle and minute aciculum. Second parapodium differing from first in shape of dorsal and ventral cirri, which are triangular with acute apex, and in having a larger neuropodium.

Recurved cirrus present from third setiger (fig. 64, *e*) to posterior end of body; with a small spherical papilla at its base near its origin from the dorsal cirrus (fig. 64, *f-h*). Dorsal and ventral cirri with thickened basal portion (fig. 64, *e-h*).

Notopodial acicular notch present throughout but more or less obsolete in posteriormost neuropodia (fig. 64, *h*). Postacicular lamellae broad, subtruncate (fig. 64, *g, h*); superior portion of median neuropodial lamellae surrounding setal fascicle with a loose, high collar (fig. 64, *f-h*).

Setae of three kinds: A few plain capillary setae in superior and inferior parts of postacicular notopodia and neuropodia; numerous long, bristled, barred capillary postacicular notosetae and neurosetae (fig. 64, *c, d*), and shorter, nonbristled, barred, capillary, preacicular notosetae and neurosetae (fig. 64, *i*).

Color in life iridescent pearl-gray to pale whitish.

*Holotype*.—U.S.N.M. no. 20320.

*Distribution*.—Dillon Beach, Calif. (type); northern and southern California. Inhabiting clean, sandy beaches (see also p. 149).

*Systematic position*.—Differing from *N. ciliata* (O. F. Müller) in having proboscis proximally smooth, in lacking (usually) the median dorsal papilla on the subdistal portion of the proboscis, in the distribution of its recurved cirri which are present almost to the end of the body, and in the proportions of the prostomium (see fig. 64, *a, b*).

*Discussion*.—*Nephtys caeca ciliata* of Berkeley (1935, p. 770) is included here because of the "absence of an unpaired papilla on the proboscis" and because the "posterior setae are unusually long". Also its distribution (Elkhorn Slough) falls within the range of *N. californiensis* as outlined above.

## NEPHTYS SCHMITTI, new species

FIGURE 65

Length 80 to 90 mm; width about 8 mm at widest part or tenth setiger; number of segments about 100. Prostomium about twice as broad as long, broadly pentagonal (fig. 65, *a*), with a shallow, median concavity in its anterior half. Prostomial antennae bluntly conical, subequal, inserted at antero-ectal margin of prostomium. Nuchal papillae near posterior margin of prostomium in line with prostomial antennae (fig. 65, *a*).

Proboscis proximally smooth except for longitudinal wrinkles of contraction; subdistally with 22 rows of papillae, 4 to 6 in a row; without median dorsal papilla.

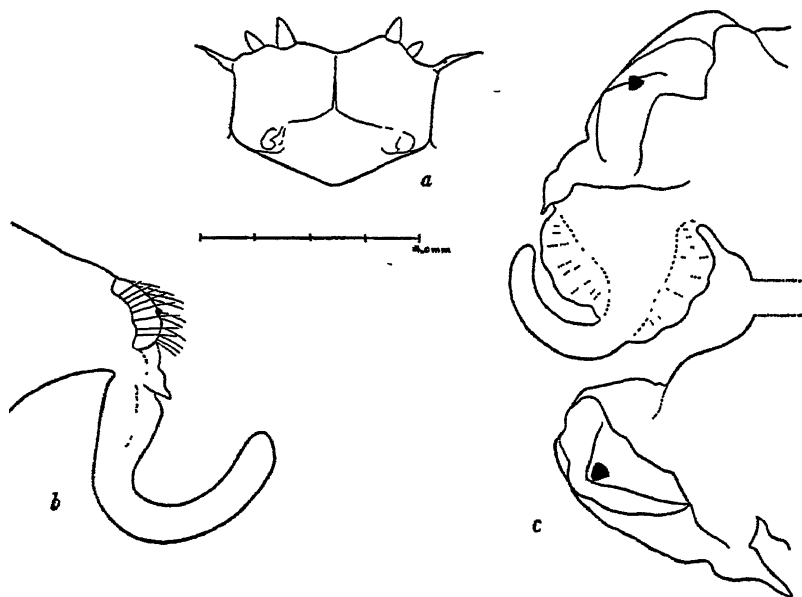


FIGURE 65.—*Nephtys schmitti*, new species: *a*, Outline of prostomium in dorsal view; *b*, notopodium of thirty-eighth parapodium in anterior view; *c*, twenty-first parapodium in anterior view (the two rami somewhat separated).

Recurved cirri present from seventh setiger, minute at first. Dorsal and recurved cirri about equal at ninth setiger. More posteriorly recurved cirri elongate and thickened; at twelfth setiger foliaceous processes arise laterally from recurved cirri and become well developed by fourteenth (fig. 65, *c*). Foliaceous lobes disappear from about thirty-sixth setiger; thereafter cirri are digitate and somewhat outwardly curved (fig. 65, *b*), continuing large to ninth last setiger, then abruptly reduced to a minute knob and absent from last eight setigers.

Parapodial lamellae poorly developed throughout, greatly reduced in posterior half of body; acicular lobes conical (fig 65, *b*, *c*); parapodial rami widely diverging after the thirty-sixth setiger.

Setae not conspicuous, consisting of smaller, prelamellar, barred setae and postlamellar simple capillary and bristled capillary setae, the latter with bristled area limited to a short, narrow region where setae emerge from parapodial lobes.

Dorsal anal cirrus as long as last 11 setigers; ventral anal cirrus tiny, somewhat longer than width of anal ring.

Named for Dr. Waldo L. Schmitt, of the United States National Museum.

*Holotype*.—U.S.N.M. no. 20323.

*Distribution*.—*Albatross* station 3210 (1890) south of the Alaska Peninsula, in 483 fathoms (type); station 3198 (1890) off central California, in 278 fathoms; station 3195 (1890) off central California, in 252 fathoms; station 2871 (lat. 46°55' N., long. 125°11' W.), in 559 fathoms.

*Systematic discussion*.—*Nephtys schmitti* has affinities with *N. phyllobranchia* McIntosh and probably also with *N. modesta* Grube. *N. phyllobranchia* McIntosh (1885, p. 164) was described from off New York in 1,240 fathoms. The description fails to give the nature of anterior and posterior recurved cirri unless they are understood to be foliaceous throughout. Such is not the case in *N. schmitti*. The number and distribution of papillary rows on the proboscis are not given except to say that *N. phyllobranchia* "approaches *N. modesta* Grube." According to Grube (1878, p. 535). *N. modesta* is provided with 12 rows of papillae. *N. schmitti* has 22 rows. Furthermore, *N. schmitti* differs from *N. modesta* in the structure of its recurved cirri. In the latter "branchiae pinnarum posteriorum brevissimae triangulae," in *N. schmitti* they are long, digitiform (fig. 65, *b*). Grube could not have referred to the last few setigers, for he had an incomplete individual of 56 segments.

Grube's species was recorded from the Indian Ocean (Kerguelen) in one place (1878, p. 535) and from the Straits of Magellan in another (p. 511). According to Ehlers (1901, p. 68) the former record is probably an error.

#### NEPHTYS RICKETTSI, new species

#### FIGURE 66

Large, robust: length to 30 cm; width to 18 mm; number of segments 110 to 120. Prostomium wider than long, broadly subtrapezoidal, its anterior margin gently curved; a deep, median, longitudinal groove extending over most of its length. Dorsal frontal antennae less than half as large as ventral antennae, the two of a

side inserted close together and widely separated from those of the other side. Nuchal papillae conspicuous, at postectal margin of prostomium.

Proboscis subdistally beset with 22 rows of papillae, 4 or 5 in a row; without median papilla; proximally covered with low, elongated, wartlike elevations, which are more like wrinkles than papillae.

Recurved cirrus first present as minute swelling on ventral side of dorsal cirrus of sixth setiger, becoming elongate triangular by tenth setiger; proximal two-thirds of cirrus thickened at twenty-third setiger, continuing gradually thicker, appearing inflated, maximum development between setigers 35-48; slenderer posteriorly, also shorter; absent from about 17 last setigers.



FIGURE 66.—*Nephtys rickettsi*, new species: a, An anterior parapodium in anterior view, with setae shown; b, thirty-fifth parapodium (slightly anterior to middle of body) in anterior view; c, a posterior parapodium in anterior view, with setae shown.

Parapodia robust, with large, imbricated, fleshy lamellae and cirri in median region. First parapodium directed anteriorly, enclosing prostomium from side; its dorsal and ventral cirri somewhat elongated, ventral cirrus roughly triangular; its notopodium with stout aciculum and well-developed setal fascicle; its neuropodium with reduced aciculum and fewer setae than are present in more posterior parapodia. Dorsal and ventral cirri of first few (five or more) segments subglobular (fig. 66, a). Median parapodia with broad, thick rami, acicular lobes unequally bilobed (fig. 66, b); postsetal lamellae broad, thick, foliaceous. Posterior parapodia plain, the rami widely diverging, lobes not noticeably developed, acicular lobes hardly discernible, the stout aciculum emerging from anterior face of parapodial lamella (fig. 66, c).

Setal fascicles not conspicuous, containing only simple capillary, simple bristled and simple barred setae. Setae few in fascicles, projecting laterally in stiff series.

Named for E. F. Ricketts, who has made numerous collections of annelids from the northeast Pacific.

*Holotype*.—U.S.N.M. no. 20322.

*Distribution*.—Cache Bay, Alaska (type), collected by Mr. Ricketts, with an individual of *N. caeca* (Fabricius). *Albatross* station 2902 (1889), off Santa Rosa Island, in 53 fathoms.

*Systematic position*.—*N. rickettsi* has affinities with the *N. caeca* group. It differs from the latter or closely related species in (1) the distribution of its recurved cirri, which are first present on the sixth setiger and absent from about the last 15 or more setigers; (2) in the shape of its recurved cirri, especially those of the posterior half of the body, these being inflated, sacklike; (3) in the nature of the parapodial lamellae, which are thicker, tougher; and (4) in the posterior acicular lobes which are not noticeably bilobed.

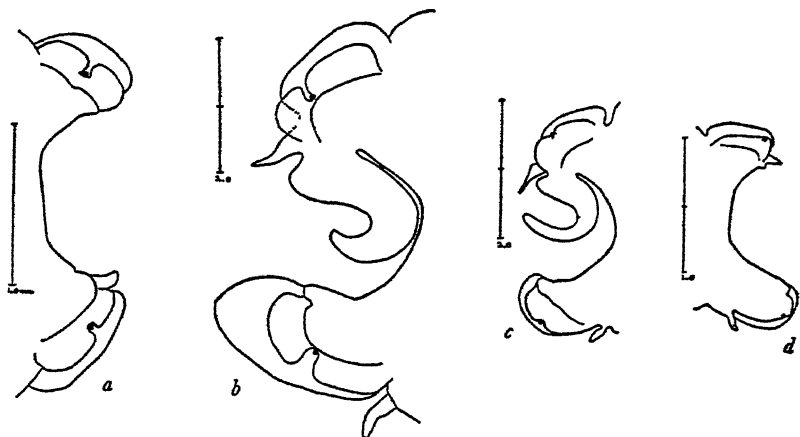


FIGURE 67.—*Nephtys punctata*, new species: a, Sixth parapodium in anterior view, ventral cirrus omitted; b, twenty-fifth parapodium in anterior view; c, parapodium from median region, in anterior view; d, twentieth last parapodium, in anterior view.

NEPHTYS PUNCTATA, new species

FIGURE 67

Length to 100 mm; width to 6.5 mm at tenth setiger or widest part; number of segments 90 to 100. Closely resembling *N. caeca* (Fabricius) in size and body proportions.

Prostomium rectangular, slightly longer than wide, with a circular depression at its median, posterior margin; nuchal papillae circular, inserted at postectal margin of prostomium; ventral antennae more than twice as large as dorsal antennae.



Proboscis with 20 bifurcated, terminal papillae; with 22 rows of subterminal papillae, 4 or 5 in a row; a conspicuous, median dorsal papilla exceeding the paired papillae in size. Proximal portion of proboscis provided with well separated, minute, prickly cones.

Recurved cirrus first present from eighth or ninth setiger, increasing in size from a minute, triangular lobe about as large as its dorsal cirrus to a thickened, sickle-shaped cirrus (fig. 67, *b, c*) at twentieth setiger; continuing large through median region; decreasing gradually in size in posterior fourth and present only as a minute knob on twentieth last setiger (fig. 67, *d*); absent from more posterior segments.

Parapodia as in figure 67, *a-d*; acicular lobes strongly bilobed in anteriormost segments (fig. 67, *a, b*), becoming only slightly bilobed in median region (fig. 67, *c*), distinctly conical in posterior region (fig. 67, *d*). Setae of three kinds: (1) Barred setae in preacicular fascicles of notopodia and neuropodia, (2) capillary setae, and (3) bristled setae in postacicular fascicles. Lyre setae not observed.

*Holotype*.—U.S.N.M. no. 20321.

*Distribution*.—*Albatross* station 3210 (1890) south of Alaska Peninsula, in 483 fathoms (type); station 4197 (1903), Gulf of Georgia, in 31–90 fathoms. Central California: *Albatross* station 3193 (1890) dredged; station 3666 (1890) in 68 fathoms; station 3202 (1890) in 382 fathoms; station 4485 (1904) in 108 fathoms.

*Systematic position*.—*Nephtys punctata* belongs to the *N. caeca* group. It is unique in the distribution of its recurved cirri (see above), in the nature of its proboscis, and in having conical acicular lobes in the posterior region.

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issued by the  
SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1938

No. 3035

## A MIOCENE DOG FROM MARYLAND

By CHARLES T. BERRY

No CANID remains hitherto have been reported from the Miocene of Maryland, and very few from other Tertiary deposits of the Atlantic Coastal Plain. The material herein described consists of two associated lower molars found in the cliff near Plumpoint, Md., on the west side of Chesapeake Bay.

I have consulted with Dr. C. L. Gazin, and he has been good enough to verify the generic allocation and to allow me to examine pertinent specimens in the United States National Museum.

### Genus TOMARCTUS Cope

**TOMARCTUS MARYLANDICA**, new species

FIGURE 68

*Type*.— $M_2$  and  $M_1$  from the left mandible, U.S.N.M. no. 15561, collected by Charles T. Berry, August 26, 1937, from zone 10 of the Calvert formation, 11 $\frac{1}{2}$  miles south of Plumpoint wharf, Calvert County, Md.

*Description*.— $M_2$  is incomplete, lacking the paraconid and anterior root. The heel of the tooth is broad and flat, with a rounded posterior margin. The entoconid is slightly higher than the hypoconid, and the connecting ridge is straight. The protoconid, the most outstanding feature of the tooth, is about twice as high as the metaconid. Halfway up the outer posterior side of the protoconid there is a very small tubercle. An obscure ridge runs from the hypoconid toward the metaconid, which is observed only in the heel portion of the tooth. The anteroposterior diameter (incomplete) of  $M_1$  is 12 mm. The greatest height at the anterior end of the preserved portion is 10.5 mm. The greatest transverse diameter of the heel is 6.5 mm.

In  $M_2$  the protoconid and metaconid are equal in size while the paraconid is reduced. The heel, which has a rounded posterior margin, is occupied by the equally developed entoconid and hypoconid, which are connected by a straight ridge. A very obscure ridge runs across the heel portion of the tooth from the hypoconid toward the metaconid. This ridge is less pronounced in  $M_2$  than in  $M_1$ . A small, poorly developed tubercle is present on the postero-external side of the protoconid. Also, a crescent-shaped rim anterior to the paraconid and protoconid is present only on the outer portion of the tooth. The anteroposterior diameter of  $M_2$  is 9 mm. The greatest transverse diameter of the heel is 5 mm. The greatest height of the tooth, including root, is 13 mm.

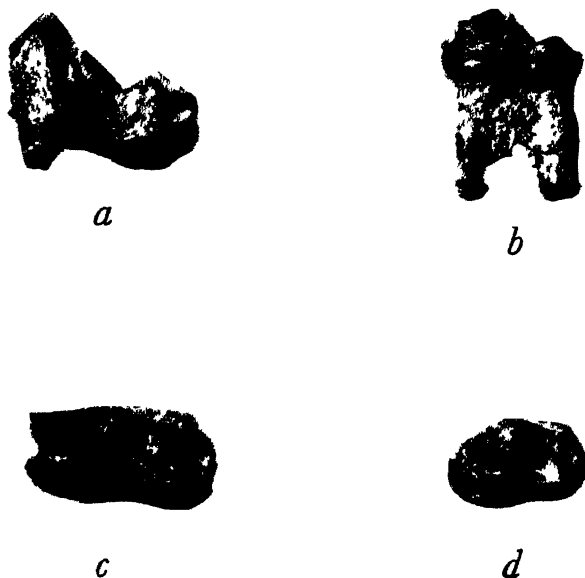


FIGURE 68—*Tomarctus marylandica* new species, left lower molars, type specimen (U. S. N. M. no. 15561): a,  $M_1$ , lateral view; b,  $M_2$ , lateral view; c,  $M_1$ , occlusal view; d,  $M_2$ , occlusal view. 2, Calvert Miocene, Maryland.

The two molars show very little wear, indicating that the animal was in the prime of life. The enamel on both is in perfect condition except for small cracks. In  $M_1$  the dentine can be seen at the anterior end.

*Comparison.*—The two molars of *Tomarctus marylandica* are closely comparable to those in *Tephrocyon kelloggi* described by Merriam<sup>1</sup> in 1911. The type of *T. kelloggi* was collected from the Virgin Valley beds (middle Miocene) in Humboldt County, Nev., and consists of "a lower jaw with dentition." The present find and

<sup>1</sup> Merriam, J. C. Univ. California Publ. Bull. Dept. Geol., vol. 6, pp. 235-238, figs. 5, 6, pl. 32, 1911.

that of Merriam compare favorably in all the outstanding features with but few exceptions. The protoconid of *T. kelloggi* appears in the illustration to be more rounded than in the present specimen. This may be due to difference in wear. A small tubercle near the base of the metaconid is mentioned in the description of  $M_1$  of *T. kelloggi*. This tubercle is absent in the present specimen, but a slight unevenness of the enamel in this region, if developed, might have been termed a tubercle.

*Remarks.*—I adopt the current usage of the generic name *Tomarctus*, assuming that *Tephrocyon* is a synonym. The Maryland form corresponds more closely to members of this group, which in the West are known from the middle Miocene, than it does to the lower Miocene species of *Cynodesmus*.

From the scant material at hand it is impossible to draw any conclusions as to the characters or habits of *Tomarctus marylandica*. It is possible, however, to enumerate its associates from the other fossil vertebrates found in the Calvert Miocene. The known vertebrate fauna includes Pisces, Chelonia, Crocodilia, Aves, Sirenia, Cetacea, Carnivora, Proboscidea, and Artiodactyla.





SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1938

No. 3036

REVISION OF THE NEARCTIC LEAFHOPPERS OF THE  
TRIBE ERRHOMENELLINI (HOMOPTERA: CICADELLIDAE)

By P. W. OMAN

THE STUDIES here presented are based on material in the United States National Museum and on specimens lent for study by Dr. E. D. Ball, of the University of Arizona, Dr. R. H. Beamer, of the University of Kansas, and J. A. Gillett, of Twin Falls, Idaho. Since representatives of the tribe are usually not abundant in collections, these loans have aided materially in the preparation of a revisional paper.

According to the available distribution records, the North American representatives of the group are confined to the western part of the United States; however, it is probable that certain species occur in adjacent sections of Canada and Mexico as well. All the species appear to be confined to arid or semiarid regions. Little is known concerning food-plant associations, but *Errhonus* appears to be restricted to the *Artemisia* belt, *Pagaronia* and *Lystridea* occur in the coastal chaparral association, while *Friscanus friscanus* is apparently confined to *Lupinus arboreus*.

The tribe Errhomenellini has usually been considered to be somewhat intermediate in character between the subfamilies Cicadellinae and Jassinae. In this view I concur but believe that the tribe should be referred to the Jassinae rather than the Cicadellinae, where it was placed by Van Duzee in his Check List, 1916, and Catalogue, 1917. It is assigned to the Jassinae because the ocelli are usually near the



margins of the crown and because the hind wings of macropterous forms have four apical cells rather than three as in the Cicadellinae.

The Errhomenellini and the closely related Evacanthini may be distinguished from other Jassinae by the position of the ocelli, which are on the crown near the anterolateral margins, and the shape of the facial sclerites, especially the clypellus, which is unusually large, broad basally, narrowed distally, and extending beyond the genae. The apex of the clypellus is rounded, not truncate, and the entire face is usually rather broad. The Errhomenellini differ from the Evacanthini in that the clypeus is without a median carina.

According to my interpretation, the genera *Errhomenellus* Puton and *Bathysmatophorus* Sahlberg are not represented in North America. For the Nearctic species previously assigned to the former, two new genera have been erected, while the name *Lystridea* Baker is available for the species referred to the latter. A third new genus is described to accommodate an apparently new species from Idaho.

#### KEY TO THE GENERA OF ERRHOMENELLINI

1. Crown without numerous fine striae..... *Errhomus*, new genus  
Crown with numerous fine, mostly longitudinal striae, at least basally..... 2
2. Head elongate and rather narrow; crown always well produced anteriorly. Species not especially robust..... 3  
Head short and broad; crown not greatly produced anteriorly, or if so, then species robust and brachypterous..... 4
3. Head subconical and pointed apically. Species macropterous... *Pagaronia* Ball  
Head blunt apically. Species subbrachypterous..... *Friscanus*, new genus
4. Head narrower than pronotum; posterior margin of pronotum incised..... *Thatuna*, new genus  
Head as broad as or broader than pronotum; posterior margin of pronotum not incised..... *Lystridea* Baker

#### Genus PAGARONIA Ball

*Pagaronia* BALL, Can. Ent., vol. 34, p. 19, 1902.

Relatively large leafhoppers, about 8–10 mm in length. Head, including eyes, distinctly narrower than pronotum; apex of head subconical and rather sharply pointed; face long and narrow, clypeus and clypellus large; crown irregularly convex, surface with numerous fine, irregular, longitudinal striae, posterior margin distinctly elevated above pronotum along its entire width and forming a distinct flange next each eye. Pronotum relatively short and broad; lateral margins carinate and diverging posteriorly; posterior margin shallowly incised medially. Fore and hind wings well developed and extending beyond tip of abdomen; central anteapical cell of fore wing usually open basally; appendix small or absent. Hind wing with four apical cells. Pecten of hind basitarsus consisting of six or seven setae of variable size, the first and last of the series spinelike.

Ovipositor sheath extending beyond tip of pygofer; female pygofer with numerous setae. Male valve hidden or very small; male plates more or less elongate; styles relatively small and curved downward distally; sternal apodemes absent.

Type of genus, *Pagaronia 13-punctata* Ball, 1902.

Three species in addition to the genotype are recognized as belonging to the genus. *Tettigonia tripunctata* Fitch, 1851 (New York State Cab., p. 55), which has been referred to *Pagaronia*, belongs in the subfamily Cicadellinae on the basis of the position of the ocelli and the venation of the hind wings, and for it the genus *Plesiommata* Provancher,<sup>1</sup> 1889 (p. 263), is available.

#### KEY TO THE SPECIES OF PAGARONIA

1. Black markings on head and thorax consisting of numerous irregular blotches (pl. 5, fig. 1)----- *triunata* Ball  
Black markings on head and thorax consisting of small, definite spots (pl. 5, fig. 2), or absent----- 2
2. Posterior margin of seventh sternite of female not notched medially. Terminal processes of aedeagus extending beyond shaft of aedeagus (pl. 5, fig. 2B)----- *furcata*, new species  
Posterior margin of seventh sternite of female with a faint notch medially. Terminal processes of aedeagus extending laterad, and to some extent back along shaft of aedeagus (pl. 5, figs. 3A, 4A)----- 3
3. Aedeagus and its terminal processes slender, the latter not serrate (pl. 5, fig. 3A)----- *confusa*, new species  
Aedeagus and its terminal processes stout, the latter serrate on outer margins (pl. 5, fig. 4A)----- *13-punctata* Ball

#### PAGARONIA TRIUNATA Ball

#### PLATE 5, FIGURES 1, 1A

*Pagaronia 13-punctata* var. *triunata* BALL, Can. Ent., vol. 34, p. 20, 1902.

Easily distinguished from other species of the genus by the irregular black markings on the head and the long, slender male plates. Length 7.7–9.25 mm.

General ground color sordid yellowish white. Clypeus with 11 or 12 pairs of short, transverse, brown or fuscous lines laterally, and a small black spot just below the apex of the head medially. Anterior margin of head with a small black spot next each eye and a large, irregular black mark in front of each ocellus, each of these frequently divided to form two irregular blotches. Crown with black to fuscous marks as follows: A small spot medially anterior to ocelli, another next each eye, a pair of elongate spots on posterior

<sup>1</sup>S. E. Crumb has called my attention to the fact that certain copies of Provancher's "Petite Faune Entomologique du Canada," vol. 3, 1889, contain the description of *Plesiommata*, which is based on a single species, *biundulata*, described as new in the same publication. It is apparent that *Plesiommata biundulata* Provancher, 1889, is synonymous with *Tettigonia tripunctata* Fitch, 1851 (new synonymy).

margin, and a large, irregular blotch between each ocellus and the adjacent eye. Pronotum with irregular black to fuscous marks on anterior one-half, especially laterally. Scutellum with a pair of faint spots on disk and sometimes faint basal triangles. All the markings on the head and thorax are subject to considerable variation in size, shape, and intensity. Fore wings of female sordid subhyaline with faint reddish brown in cells; fore wings of male usually with cells distinctly red or reddish brown, veins pale. Hind wings smoky subhyaline. Abdomen usually with extensive fuscous markings.

Median length of crown slightly less than width of crown at anterior margin of eyes; median length of pronotum slightly greater than median length of crown. Posterior margin of seventh sternite of female slightly produced and with a faint notch medially. Male plates long, slender, and nearly parallel-sided; length over three times their combined basal width; tips bluntly pointed; distal two-thirds set with numerous setae.

Posterior margin of male pygofer with two pairs of slender, finger-like processes, the ventral pair extending dorsad and slightly caudad, the dorsal pair much shorter and directed caudad. Aedeagus stout; the portion carrying the ejaculatory duct extending first dorsad and then caudad; the apex obliquely truncate in lateral view, bifurcate in dorsal view.

*Distribution*.—Known only from California. In addition to the types, which are from Santa Clara County (Coquillett) and Santa Cruz Mountains (Koebele), there are examples at hand from Salinas (Ball), Alameda (Van Dyke), Honda (Oman), and specimens from the Uhler collection labeled "Congr.," which presumably means either Congress Junction or Congress Springs, both localities in Santa Clara County. The above localities indicate a rather limited distribution in the coastal hills near San Francisco.

**PAGARONIA 13-PUNCTATA Ball**

**PLATE 5, FIGURES 4, 4A**

*Pagaronia 13-punctata* BALL, Can. Ent., vol. 34, p. 20, 1902.

*Pagaronia 13-punctata* var. *octopunctata* KIRKALDY, Proc. Hawaiian Ent. Soc., vol. 2, p. 70, 1909 (new synonymy).

Color markings on head and pronotum consisting of a pattern of definite black spots. Length 8–9.5 mm.

General ground color pale green to pale yellow, with 13 black spots as follows: One on clypeus just below apex of head, a pair on margin of crown near apex, one on the median line anterior to the ocelli, one below and one behind each ocellus, a pair on posterior margin of crown, and three arranged in a transverse row on the disk of the pronotum. The three pronotal spots (especially the two lateral

ones), the median spot on the crown, and the spots below the ocelli may be inconspicuous or absent, but the remaining spots are nearly always distinct. Fore wings subhyaline, sometimes with the cells golden-yellow.

Head slightly more pointed than in *triunata*, otherwise similar. Posterior margin of seventh sternite slightly produced and shallowly notched medially. Male plates slender, nearly three times as long as basal width, together slightly troughlike, not so flat as in *triunata*; tips blunt; surface set with numerous setae.

Male pygofer without processes. Aedeagus stout, extending dorsad and slightly caudad, bearing near the tip a pair of tapered processes that extend first ventrad and then laterad.

*Distribution*.—Recorded only from California. The types are from Los Angeles County (Coquillett and Koebele), Pasadena (Fall), and Marin County (Fuchs). It is probable that the specimens from Marin County are not *13-punctata* but *confusa*. Kirkaldy's *octopunctata* from the Santa Barbara foothills appears to be based on an example of *13-punctata* that lacks the pronotal spots and the spots below the ocelli. This is a common variation and is not believed to be worthy of a name. Other localities represented in the material at hand are Lancaster (Uhler collection), Mint Canyon (Oman), and above Mint Canyon (Oman). Mint Canyon is between Saugus and Palmdale. The above records indicate a rather limited distribution in the low hills near Los Angeles.

PAGARONIA CONFUSA, new species

PLATE 5, FIGURES 3, 3A

Superficially identical with *13-punctata*, with which it has apparently been confused, but with the male plates broader and the lateral processes of the aedeagus not curved. Length 8–9.5 mm.

General color as in *13-punctata*. Spots below ocelli and lateral spots on pronotum usually absent. Cells of fore wings of males pale orange-yellow, of females pale yellow to pale sordid yellow.

Head slightly more pointed than in *13-punctata*. Seventh sternite of female as in *13-punctata*. Male plates relatively slender, but distinctly broadened near base and then tapering to bluntly rounded tips; surface set with numerous setae.

Pygofer without processes. Aedeagus long and slender, curved dorsad posteriorly; apex with a pair of slender, pointed processes which extend ventrad and laterad.

*Type locality*.—Mount Diablo, Calif.

*Types*.—U.S.N.M. no. 52220.

*Remarks*.—The entire type series, consisting of the holotype male, allotype female, and 13 male and 8 female paratypes, were taken by the writer and Mrs. Oman at the type locality, June 21, 1935.

*Distribution.*—In addition to the type series there are at hand specimens from San Rafael (Oman), Sausalito (Thompson), and Palo Alto (Baker), Calif., and Reno?, Nev. (Brown).

**PAGARONIA FURCATA, new species**

**PLATE 5, FIGS. 2-2B**

Superficially resembling *13-punctata* Ball but larger, more robust, and with much broader male plates. Length 8.75–10 mm.

General ground color pale green to greenish white. Black spots on head and pronotum as in *13-punctata* but frequently with an additional spot below each ocellus and a spot on the median line of the pronotum anteriorly. Fore wings with veins whitish subhyaline; cells orange in the males, pale yellow or pale sordid yellow in the females. Hind wings subhyaline.

Head pointed but not so distinctly so as in *13-punctata*. Posterior margin of seventh sternite of female slightly produced and unnotched. Male plates much broader basally than in *13-punctata*, broadened still more near base, and tapering to bluntly rounded tips, the posterior two-thirds set with numerous setae.

Male pygofer without processes. Aedeagus long and slender, the portion carrying ejaculatory duct curving dorsad posteriorly and ending in a pair of slender, pointed processes which extend on beyond tip of aedeagus.

*Type locality.*—Cold Springs, Sequoia National Forest, Calif.

*Types.*—U.S.N.M. no. 52221.

*Remarks.*—The type series consists of the holotype male, allotype female, and 11 male and 10 female paratypes taken at the type locality by the writer and Mrs. Oman, June 10, 1935.

**FRISCANUS, new genus**

Intermediate in character between *Pagaronia* Ball and *Errhomus*, new genus; differing from the former in having shorter wings and no spinelike setae in the pecten of the hind basitarsus, and from the latter in the character of the surface of the crown, which has numerous fine, longitudinal striae.

Head, including eyes, slightly narrower than pronotum; crown nearly flat, median length greater than length of pronotum. Pronotum rather short and broad; lateral margins carinate. Scutellum small. Fore wings subcoriaceous and rather short, not reaching to tip of abdomen, lacking appendices; venation variable. Hind wings short, reaching fifth or sixth abdominal segment. Pecten of hind basitarsus consisting of five setae of nearly uniform size, none of which are spinelike. Sexual dimorphism apparent.

Ovipositor sheath extending beyond tip of pygofer; female pygofer with numerous short setae. Male valve small, usually concealed; male plates slender and elongate; styles small, curved laterad and ventrad distally; male with two pairs of sternal apodemes, arising from the second and third abdominal segments.

Type of the genus, *Errhomenellus friscanus* Ball, 1909. No other species belonging to the genus are known.

FRISCANUS FRISCANUS (Ball)

PLATE 5, FIGURE 6

*Errhomenellus friscanus* BALL, Can. Ent., vol. 41, p. 182, 1909.

*Memnonia simplex* VAN DUZEE, Proc. California Acad. Sci., vol 7, p. 294, 1917 (new synonymy).

Rather robust leafhoppers without distinctive markings. Length of female 5.75–6 mm, of male 3.75–4.1 mm.

Female nearly uniformly pale green. Male pale green or powdery green, with fuscous to black markings as follows: A pair of stripes across crown and pronotum, converging and sometimes fused anteriorly, frequently reduced to two pairs of spots on the crown and two faint, irregular stripes on pronotum; basal triangles on scutellum, frequently entirely absent; areas on fore wing, particularly the clavus and apical and costal cells; portions of dorsum of abdomen and tips of plates; inner surface of fore tibia and distal tarsal segment of first two pairs of legs. Most of these markings are at times indistinct or absent.

Crown of female 1.6 times as long as pronotum, that of male 1.4 times as long as pronotum. Posterior margin of seventh sternite of female slightly produced and with a small notch medially. Male plates long and slender, curved upward posteriorly, tapering slightly to rounded tips.

Male pygofer with a pair of slender, pointed, fingerlike processes arising ventrally and extending dorsad and caudad along posterior margins of pygofer. Aedeagus simple, stout basally, terminal portion slender and pointed and directed dorsad. Both pairs of sternal apodemes heavily sclerotized and black, the first pair rather slender, the second pair broad.

*Distribution*.—Originally described from material collected at San Francisco, Calif. All specimens of the rather extensive collection at hand came either from San Francisco or from localities along the coast a short distance south of San Francisco. I have found nymphs and adults abundant on *Lupinus arboreus* in June.

ERRHOMUS, new genus

Related to *Errhomenellus* Puton, with which it has been confused, but differing from that genus as fixed by its type, *brachypterus*

Fieber, in having a shorter rostrum, the lateral margins of the genae not notched below the eyes, a shorter, broader face, and the crown usually without a distinct median carina.

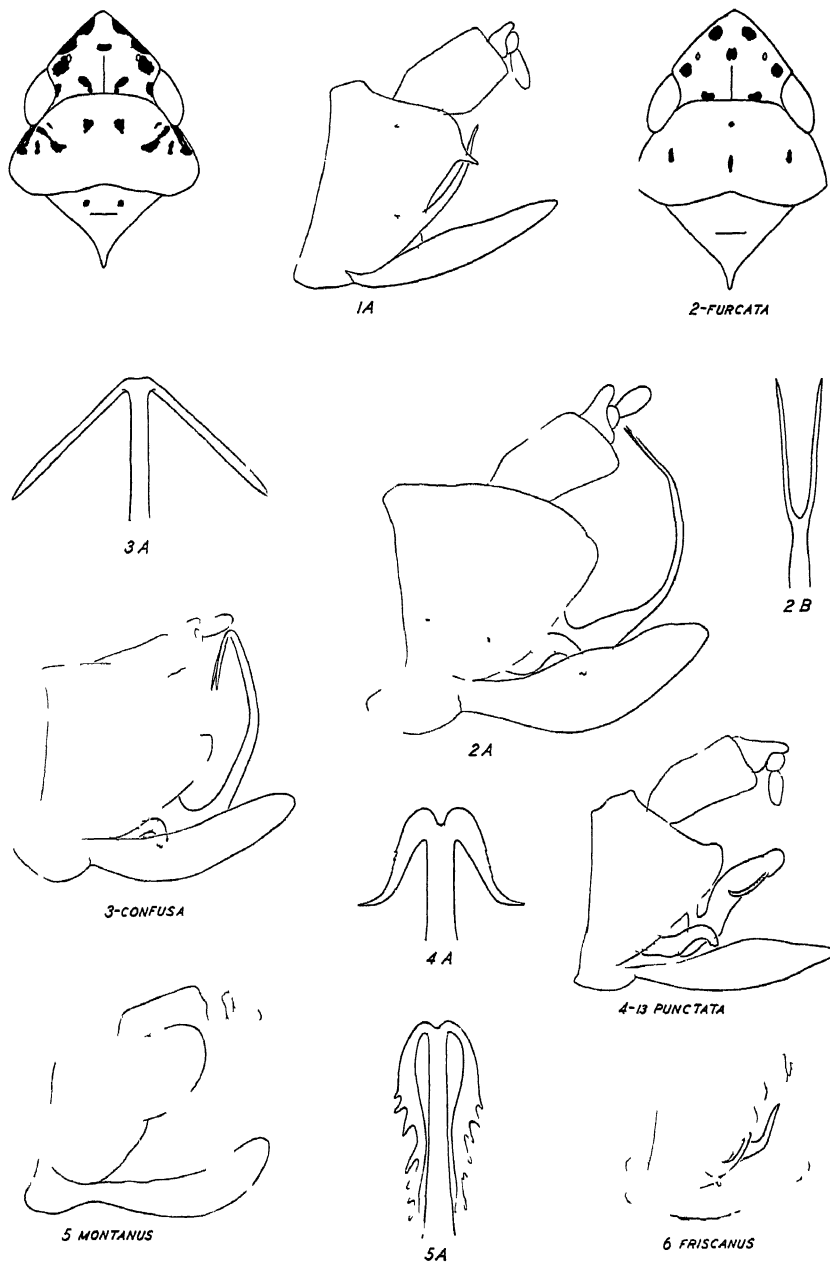
Crown as long as, or usually longer than, the pronotum; margin between crown and face either rounded or carinate. Pronotum short, posterior one-half usually faintly, transversely striate; lateral margins carinate; posterior margin shallowly incised. Males brachypterous, subbrachypterous, or macropterous; fore wings membranous or sometimes subcoriaceous; venation irregular, with outer antepical cell usually absent or small and central antepical cell usually open basally; appendix absent. Females brachypterous so far as known; fore wings usually subcoriaceous. Pecten of hind basitarsus usually composed of four to six setae in an uneven row. Sexual dimorphism apparent.

Ovipositor sheath extending beyond tip of pygofer. Male pygofer appressed. Male valve small; plates long and slender; styles long, slender, and curved upward distally; pygofer with a pair of hook-like processes next anal tube; sternal apodemes absent.

Type of the genus, *Errhomenus lineatus* Baker, 1898. The species assigned to the genus may be divided into two subgenera, as indicated by the following key:

#### KEY TO THE SPECIES OF ERRHOMUS

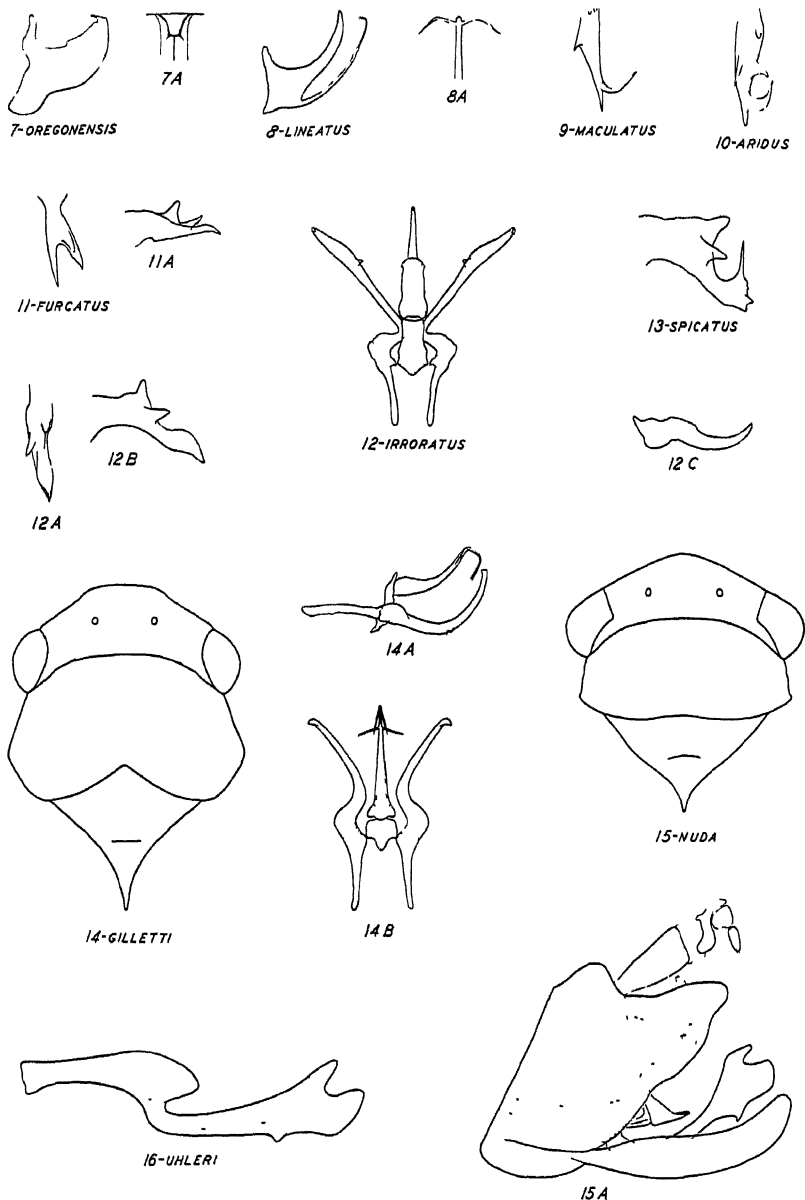
1. Anterior margin of crown not distinctly carinate. Clypeus distinctly swollen; suture between clypeus and lateral facial sclerites deeply impressed. (Subgenus *Errhomenus*)----- 2
- Anterior margin of crown distinctly carinate. Clypeus not distinctly swollen; suture between clypeus and lateral facial sclerites not deeply impressed. (Subgenus *Carsonus*)----- 4
2. Eyes somewhat bulbous. Very robust species; males subbrachypterous----- *oregonensis* (Baker)
- Eyes not bulbous. Not unusually robust species; males macropterous so far as known----- 3
3. Posterior margin of seventh sternite of female produced and with a small median notch. Lateral processes of aedeagus rather stout and serrate on outer margins----- *montanus* (Baker)
- Posterior margin of seventh sternite of female broadly and rather shallowly incised. Lateral processes at tip of aedeagus slender and not serrate----- *lineatus* (Baker)
4. Anterior margin of head neither thin nor subfoliaceous; disk of crown convex----- *irroratus* (Ball)
- Anterior margin of head thin and subfoliaceous; disk of crown flat or concave----- 5
5. Crown of female only slightly produced medially, anterior margin rounded. Pygofer process of male as illustrated in plate 6, figure 9----- *maculatus* (Gillette and Baker)
- Crown of female distinctly produced and subangular. Pygofer process of male not as above----- *aridus* (Ball)



## LEAFHOPPERS OF GENERA PAGARONIA ERRHOMUS AND FRISCANUS

1, *Pagaronia triunata* Ball, head and thorax, 1A, lateral view of male genitalia, 2, *P. furcata*, new species, head and thorax, 2A, lateral view of male genitalia, 2B, caudodorsal view of tip of aedeagus, 3, *P. confusa*, new species, lateral view of male genitalia, 3A, caudal view of tip of aedeagus, 4, *P. 15-punctata* Ball, lateral view of male genitalia, 4A, dorsal view of tip of aedeagus, 5, *Errhomus montanus* (Baker), lateral view of genital capsule of male, showing pygofer process, 5A, dorsal view of tip of aedeagus, 6, *Friscanus friscanus* (Ball), lateral view of male genitalia



LEAFHOPPERS OF GENERA *ERRHOMUS*, *THATUNA*, AND *LYSTRIDEA*.

7, *Errhonus oregonensis* (Baker), lateral view of aedeagus; 7A, dorsal view of apex of aedeagus; 8, *E. lineatus* (Baker), lateral view of aedeagus; 8A, caudal view of tip of aedeagus; 9, *E. maculatus* (Gillette and Baker), dorsal view of pygofer process of male; 10, *E. aridus* (Ball), dorsal view of pygofer process of male; 11, *E. aridus furcatus*, new subspecies, dorsal view of pygofer process of male; 11A, lateral view of same; 12, *E. irroratus* (Ball), dorsal view of styles, connective, and aedeagus; 12A, dorsal view of male pygofer process; 12B, lateral view of same; 12C, lateral view of aedeagus; 13, *E. irroratus spicatus*, new subspecies, lateral view of pygofer process of male; 14, *Thatuna gillettei*, new species, head and thorax; 14A, lateral view of styles, connective, and aedeagus; 14B, dorsal view of same; 15, *Lystridea nuda*, new species, head and thorax; 15A, lateral view of male genitalia; 16, *L. uhleri* (Baker), lateral view of style.

**ERRHOMUS (ERRHOMUS) OREGONENSIS (Baker)**

## PLATE 6, FIGURES 7, 7A

*Errhomenus oregonensis* BAKER, Psyche, vol. 8, p. 262, 1898

Very robust, with the short, broad fore wings adding to the robust appearance. Length of female 7.5–9 mm, of male 5.25–5.75 mm.

Ground color sordid yellowish white. Clypeus marked with transverse bars of fuscous to black; crown with irregular fuscous to black marks near apex and next eyes, and a pair of black spots at base. Pronotum with a black area behind each eye and a transverse row of irregular black or fuscous markings. Fore wings with faint irregular brown to fuscous markings except for an area on disk; veins usually sordid white. Abdomen and legs variously marked with brown, fuscous, or black. All the markings of this species are extremely variable in intensity and size, and there are frequently irregular spots in addition to those mentioned.

Crown slightly longer than pronotum, slightly depressed laterad of each ocellus. Pronotum of nearly uniform length throughout its width. Fore wings rounded apically, extending to the fifth to eighth abdominal segment; veins prominent, venation irregular.

Posterior margin of seventh sternite of female faintly incised medially. Male plates rather slender, tapering slightly from base to bluntly pointed tips. Tips of plates bent upward and diverging slightly.

Pygofer process of male broad, subtruncate distally, with a very short, toothlike protuberance projecting ventrad from the caudal margin. Aedeagus stout; tip truncate, with two pairs of short, spinelike projections, two extending laterad and two cephalad. Tips of styles hooked upward.

*Distribution.*—Originally described from specimens collected in Oregon by Koebele and one female from Corvallis, Oreg., collected by A. B. Cordley. Of these, a male specimen bearing Baker's red determination label is considered to be the type. In addition to the Oregon specimens I have examined one female from Humboldt, Calif. (H. S. Barber), and males, females, and one nymph from Paradise Valley, Mount Ranier, Wash. (W. W. Baker).

**ERRHOMUS (ERRHOMUS) MONTANUS (Baker)**

## PLATE 5, FIGURES 5, 5A

*Errhomenus montanus* BAKER, Psyche, vol. 8, p. 262, 1898

Less robust than *oregonensis*, head subangular rather than bluntly rounded. Males macropterous. Length of female 7.25–7.75 mm, of male 5.5–6 mm.

Females pale sordid yellow mottled and marked with brown to fuscous. Males similarly colored, but usually with more extensive fuscous markings, sometimes almost wholly fuscous except for veins of fore wings, which are either unmarked or irregularly marked with fuscous.

Anterolateral margins of crown nearly straight. Crown of female about one and one-half times as long as pronotum, that of male only slightly longer than pronotum. Venation of fore wing of male irregular; outer anteapical cell absent, central anteapical cell open basally, inner anteapical cell either open or closed basally; costal area with a few irregular veins from radius to costal margin in region of anteapical cells. Fore wing of female obliquely subtruncate, reaching to third abdominal segment.

Seventh sternite of female long, posterior margin produced and with a faint median notch. Male plates slender, diverging apically, slightly narrowed between base and middle.

Pygofer processes of male rather slender and sharply pointed distally. Aedeagus rather slender, bearing at the tip a pair of sinuately curved processes, which extend down along the shaft of the aedeagus and are coarsely and irregularly serrate on the outer margins. Styles slender, pointed distally.

*Distribution*.—Originally described from seven specimens from northern Colorado, the specific localities mentioned being Fort Collins and Cameron Pass. One of these, a male from Rabbit Ears Pass, bears Baker's determination label and is considered to be the type. In addition to the type series, I have examined specimens from Little Beaver, Colo. (Ball), Soldier Creek, Utah (Knowlton), and Fish Lake Mountain near Richfield, Utah (no collector).

ERRHOMUS (ERRHOMUS) LINEATUS (Baker)

PLATE 6, FIGURES 8, 8A

*Errhomenus lineatus* BAKER, Psyche, vol. 8, p. 261, 1898.

Superficially identical with *montanus* but with head slightly shorter and blunter and the processes of the aedeagus not serrate. Males macropterous. Length of female 7.25–8 mm, of male 6–7 mm.

Color as in *montanus* but with less mottling and more distinct spots. Structure about as in *montanus* except as noted. Seventh sternite of female with posterior margin very shallowly incised. Male plates as in *montanus*.

Pygofer processes of male similar to those of *montanus* but not so sharply pointed. Distal portion of aedeagus composed of two parts, a stout, curved dorsal portion without terminal processes, and a slender, curved, ventral portion which carries the ejaculatory duct and terminates in a pair of slender, fingerlike processes.

*Distribution*.—The original description was based on specimens of both sexes from Pullman, Wash. (C. V. Piper). One of the females, which bears Baker's red label, is considered the type. I have also examined specimens from the following localities in Washington: Yakima (A. R. Rolfs), Ritzville (M. C. Lane), north of Dryden (A. L. Melander), Ellensburg (W. W. Baker); and Moscow, Idaho (J. Gillett).

CARSONUS, new subgenus

Differing from typical *Errhomus* as indicated in the key, and in addition having the hooklike processes of the male pygofer heavily sclerotized and bearing sharp spines or serrations, or both. In the subgenus *Errhomus* the hooklike processes of the male pygofer are of the same texture as the pygofer, and are bent ventrad posteriorly. In *Carsonus* the style has a sharp toothlike projection on the ventral surface about one-third the distance from the apex. Aedeagus of *Carsonus* as illustrated (pl. 6, figs. 12, 12C).

Type of the subgenus, *Acocephalus maculatus* Gillette and Baker, 1895.

ERRHOMUS (CARSONUS) IRRORATUS (Ball)

PLATE 6, FIGURES 12-12C

*Errhomenellus irroratus* BALL, Can. Ent., vol. 34, p. 18, 1902.

Rather robust; face strongly convex; crown of female distinctly longer than that of male. Length of female 5.5-6.5 mm, of brachypterous male 3.75-4 mm, of macropterous male 4.4-5 mm.

Female pale sordid yellow, heavily irrorate with fuscous and black; male fuscous to black, with numerous small circular yellow spots. Crown of female longer than pronotum, that of male equal to or shorter than pronotum. Fore wings of brachypterous specimens obliquely subtruncate, reaching to base of fourth abdominal segment. Fore wings of macropterous males with outer anteapical cell either present or absent, central and inner anteapical cells either open or closed basally.

Seventh sternite of female long; posterior margin notched medially and strongly sinuated between median notch and lateral angles. Male plates slender, of nearly uniform width; tips blunt.

Pygofer process of male with two toothlike projections, distal portion rounded and finely serrate on dorsal margin. Style broadened before apex and with a hook on ventral surface; tip pointed and recurved. Aedeagus rather stout basally, tapering distally and slightly curved.

*Distribution*.—Originally described from two females from Siskiyou County, Calif. (Koebele). The description of the male is based

upon a specimen collected near Bray, Calif. (Siskiyou County), June 29, 1935 (Oman). I have examined a long series of specimens including adults of both sexes and one nymph from Bray (Beamer and Oman); females from Weed, Calif. (Ball); near Bend, Oreg. (Beamer and Oman); Cliffdell, Wash. (Oman); Naches, Wash. (Beamer); and males and females from Craig, Colo. (Beamer).

**ERRHOMUS (CARSONUS) IRRORATUS SPICATUS, new subspecies**

PLATE 6, FIGURE 13

Externally identical with typical *irroratus* but with the pygofer process of the male with an erect, spinelike extension of the dorsal margin distally.

*Type locality*.—Criterion Pass, Oreg.

*Types*.—U.S.N.M. no. 52222.

*Remarks*.—Described from two macropterous males, the holotype collected July 2, 1935, by the writer, paratype from Tampico, Wash., May 16, 1932, A. R. Rolfs.

The true significance of the differences found in the pygofer processes of the males and the heads of the females belonging to this subgenus is not clear, and the problem is made more difficult by the rather infrequent association of specimens of the two sexes in material collected at a single locality. Because *aridus* Ball shows considerable uniformity of structure in material from several localities, I have decided to call attention to certain other segregates by describing them as subspecies of *irroratus* or *aridus*.

**ERRHOMUS (CARSONUS) MACULATUS (Gillette and Baker)**

PLATE 6, FIGURE 9

*Acocephalus maculatus* GILLETTE and BAKER, Colorado Agr. Expt. Stat. Bull. 31, p. 83, 1895.

Resembling *irroratus* but with crown flat or concave and posterior margin of seventh sternite of female less deeply incised. Length of female 6–6.5 mm, of brachypterous male 4–4.25 mm, of macropterous male 4.75 mm.

Color as in *irroratus* but usually not so dark. Crown rather short, not subangular at apex. Fore wings of brachypterous specimens reaching fourth abdominal segment; macropterous males usually with three anteapical cells in fore wing.

Seventh sternite of female large; notches and sinuations in posterior margin not so pronounced as in *irroratus*. Male plates about as in *irroratus*.

Pygofer process of male ending in one straight spine and one slender spine which curves mesad. Styles and aedeagus as in *irroratus*.

*Distribution.*—In addition to three specimens from Colorado (Baker collection), I have examined two females from Soldier, Utah (Ball), and a male from Ephraim, Utah (Ball).

*Remarks.*—According to the statement accompanying the original description of *maculatus*, it was described from two female specimens, but after a careful study of the description and illustrations, together with a male specimen labeled "type," I have concluded that the type specimens were actually males. The specimen labeled "type" fits exactly the illustrations of the head and genitalia, and the length is nearly as indicated. What is described and illustrated by Gillette and Baker as the last ventral segment of the female is actually the shallowly incised and strongly appressed eighth sternite of the male. Moreover, the plates of this male bear a strong resemblance to the ovipositor sheath of a teneral female.

ERRHOMUS (CARSONUS) ARIDUS (Ball)

PLATE 6, FIGURE 10

*Errhomenellus aridus* BALL, Can. Ent., vol. 41, p. 183, 1909.

Closely related to *maculatus*, but with the apex of the crown subangular and the posterior lateral angles of the seventh sternite of the female more produced. Length of female 6–6.5 mm, of brachypterous male 4 mm, of macropterous male 4.5 mm.

Pale sordid yellow, with irregular spots and maculations of brown and fuscous. Usually with fewer dark markings than either *irroratus* or *maculatus*.

Macropterous male usually with three closed anteapical cells in fore wing. Seventh sternite of female long, posterior margin much produced laterally, incised medially, and either incised or strongly sinuated between median notch and lateral angles. Male plates as in *irroratus*.

Pygofer process of male with two curved, hooklike projections extending mesad. Styles and aedeagus as in *irroratus*.

*Distribution.*—Originally described from four males from Reno, Nev. The description of the female is based upon a specimen from the type locality, April 30, 1908, E. D. Ball. Examples of *aridus* are at hand from Reno, Nev. (Ball); "Nevada" (Uhler collection); Kanab, Utah (Ball); Craig, Colo. (Beamer); Durango, Colo. (Oman); Naches, Wash. (Beamer); and Cliffdell, Wash. (Oman).

ERRHOMUS (CARSONUS) ARIDUS FURCATUS, new subspecies

PLATE 6, FIGURES 11, 11A

Externally identical with typical *aridus* but with the pygofer process of the male bifurcate posteriorly in dorsal view, the two forks

rather short and pointed. In the type a dorsal toothlike projection is much more prominent than in either of the two paratypes, which may represent a still different segregate.

*Type locality*.—Easton, Wash.

*Type and paratype*.—U.S.N.M. no. 52223.

*Paratype*.—University of Kansas collection.

*Remarks*.—Described from three macropterous males; the holotype collected by A. Koebele (no date), one paratype from Wenatchee Mountains, Wash., July 9, 1930, F. P. Dean, and one paratype from Mount Rainier, Wash., July 6, 1935, R. H. Beamer.

ERRHOMUS (CARSONUS) ARIDUS INCERTUS, new subspecies

Slightly larger than typical *aridus*; length of female 6.75–7 mm. Compared with typical *aridus* the crown is shorter, the clypeus more convex, and the posterior lateral angles of the seventh sternite of the female are less produced.

*Type locality*.—Cajon Pass, Calif.

*Types*.—U.S.N.M. no. 52224.

*Remarks*.—Described from a series of 82 females (holotype and paratypes) collected at the type locality by the writer and Mrs. Oman, June 6, 1935.

*Distribution*.—In addition to the types, other female specimens are at hand from the following California localities: Warner Springs (Oman), Macdoel (Oman), Doyle (Ball), Chilcoot (Ball), and Dorris (Beamer).

THATUNA, new genus

Closely related to *Bathysmatophorus*<sup>2</sup> Sahlberg, with which it agrees in general habitus and in the structure of the head and pronotum, but differing from that genus in the venation of the fore wing, which has the outer anteapical cell small and triangular and the central anteapical cell usually open basally.

Large, rather elongate leafhoppers. Head, including eyes, narrower than pronotum; face rather short and sparsely pilose; clypeus greatly swollen, especially near base of clypellus; margin between face and crown blunt and indefinite; crown rather short, surface uneven and with a few irregular, mostly longitudinal striae. Ocelli small, eyes somewhat bulbous. Pronotum about one-half as long

<sup>2</sup>I am not familiar with *B. reuteri* Sahlberg, 1871 (Notiser ur sällskapetets pro fauna et flora Fennica förhandlingar, vol. 12, p. 111), the type of *Bathysmatophorus*, and my concept of the genus is based upon a study of the original description and Fieber's illustrations on pl. 10 of Rev. et Mag. Zool., 1876.

as wide, lateral margins long and distinctly carinate, posterior margin shallowly incised, surface irregularly transversely striate on posterior one-half. Scutellum large. Fore wing of male long, extending well beyond tip of abdomen; venation irregular, second cross vein extending obliquely distad from media to cubitus, appendix nearly absent; texture subcoriaceous, surface sparsely pilose along veins. Costal area of hind wing much wider basally than near hamulus. Female unknown, probably brachypterous. Pecten of hind basitarsus composed of five or six setae, these not clearly differentiated from the numerous setae covering the lower surface of the tarsal segment.

Male valve very small; plates long and slender; styles exceedingly long; pygofer with a pair of hooklike processes next to anal tube; sternal apodemes absent.

Type of the genus, *Thatuna gilletti*, new species.

THATUNA GILLETTI, new species

PLATE 6, FIGURES 14-14B

Length of male 8.5 mm. Ground color sordid yellowish white, heavily mottled with fuscous to black. Fore wing with numerous sordid white spots, the largest of these being along coastal margin or apically on veins. Hind wing smoky subhyaline.

Male plates turned upward distally, apices slightly diverging. Styles extending beyond plates, curved upward posteriorly, each with a small toothlike process on outer ventral surface at about the middle of posterior portion. Aedeagus broad basally, tapering distally, curved first caudad and dorsad, then bent abruptly ventrad at the distal end of the ejaculatory duct and bent again so that the terminal portion is directed ventrad and cephalad, bearing at the opening of the ejaculatory duct a pair of slender processes which extend laterad and slightly cephalad; distal portion forked. Hooklike processes of pygofer stout, pointed, and directed ventrad distally.

*Type locality*.—Moscow, Idaho.

*Type and paratypes*.—U.S.N.M. no. 52225.

*Paratypes*.—In collections of J. A. Gillett, E. D. Ball, and University of Kansas.

*Remarks*.—Described from a series of 10 male specimens as follows: Holotype and six paratypes from the type locality, May 31, 1931, J. Gillett; two paratypes from Cedar Mountain, Moscow, Idaho, June 24, 1920, M. C. Lane; and one paratype from Troy, Idaho, May 31, J. M. Aldrich.

I take pleasure in naming this unusual species for Joseph A. Gillett, who has collected many interesting leafhoppers in Idaho.



Genus **LYSTRIDEA** Baker \*

*Lystridea* BAKER, Psyche, vol. 8, p. 261, 1898.

Related to *Thatuna*, new genus, but with the head as wide as or wider than the pronotum, the clypeus less swollen, and the posterior margin of the pronotum not incised. Rather large, robust leaf-hoppers.

Head, including eyes, usually slightly wider than pronotum. Crown nearly flat, broad, and rather short; surface with numerous irregular striae behind ocelli. Ocelli small. Pronotum short and broad; lateral margins short and carinate; posterior margin very shallowly concave; surface transversely striate on posterior one-half. Males macropterous; wings membranous, venation variable but usually forming three anteapical cells, second cross vein between media and cubitus usually present and joining media at or anterior to base of central anteapical cell; appendix absent. Females brachypterous, fore wings subcoriaceous, venation variable and frequently obscure. Pecten of hind basitarsus consisting of six to eight setae of variable size, the first and last of the series usually spinelike. Sexual dimorphism apparent.

Ovipositor sheath extending well beyond tip of pygofer; female pygofer with only a few small setae. Male valve small, usually concealed; male plates long and slender; styles very long, compressed distally; sternal apodemes absent; pygofer with a pair of hooklike processes next anal tube.

Type of the genus, *Lystridea conspersa* Baker, 1898, which is a synonym of *Bathysmatophorus uhleri* Baker, 1898.

## KEY TO THE SPECIES OF LYSTRIDEA

Distal portion of aedeagus with many stout setae. Species large. *uhleri* (Baker)

Distal portion of aedeagus without setae. Species smaller. Dis-

tribution, southern California----- *nuda*, new species

## LYSTRIDEA UHLERI (Baker)

## PLATE 6, FIGURE 16

*Bathysmatophorus uhleri* BAKER, Psyche, vol. 8, p. 260, 1898.

*Lystridea conspersa* BAKER, Psyche, vol. 8, p. 261, 1898.

A large species, the males rather elongate, the females robust. Length of female 8-10 mm, of male 7-9 mm. Width of head of female 2.75-3 mm, of male 2.5-2.75 mm.

\* Following his description of *Bathysmatophorus uhleri*, Baker, referring to his type specimens, states: "These specimens bore the Mss. name *Lystridea conspersa* Uhl." This association of the name *Lystridea conspersa* with the description of *B. uhleri* appears to satisfy the requirements of Article 25 of the International Rules of Zoological Nomenclature and validates the name as a synonym of *B. uhleri*. The specific name *conspersa* must remain a synonym of *uhleri*, but the generic name *Lystridea* is available for the species indicated.

General color brown mottled with fuscous; females often pale sordid yellow to gray with fuscous marks, and sometimes with large, irregular white marks basally and apically on fore wing.

Crown of female produced medially, about one-half longer medially than next the eye; crown of male shorter, about one-third longer medially than next the eye. Pronotum of female very short, about equal to crown in length; that of male proportionately much longer, at least one and one-half times as long as crown. Fore wing of female reaching to about the middle of the eighth tergite; anteapical cells usually present but much shortened; apical cells very short. Fore wing of male extending well beyond tip of abdomen.

Posterior margin of seventh sternite of female with a V-shaped notch medially extending over halfway to base of segment; margin between notch and lateral angles slightly sinuated. Male plates curved slightly upward posteriorly, together elongate triangular; lateral margins curved upward; surface set with numerous fine setae.

Processes on male pygofer heavily sclerotized, extending caudad but tips pointed and curved mesad. Aedeagus stout, curved upward posteriorly, distal portion with many stout setae laterally, these directed back along the shaft of the aedeagus. Inner surface of style concave distally; dorsal terminal projection bent mesad and forming a distinct hook; shaft with a toothlike projection on lower outer surface near apex.

*Distribution.*—The distribution of *uhleri* appears to be primarily northern California and Oregon, but there are also specimens at hand from as far south in California as Los Angeles and from Nevada (without specific locality).

*Remarks.*—Baker's type series of *uhleri* contained specimens of two species, but the name *uhleri* is here restricted to the species represented by Baker's single female cotype from Dunsmuir, Calif. (Wickham), which bears his red determination label and is considered to be the type specimen.

#### LYSTRIDEA NUDA, new species

#### PLATE 6, FIGURES 15, 15A

Closely related to, and previously confused with, *Lystridea uhleri*, but smaller and the males with shorter wings. Length of female 6.75–8.25 mm, of male 5.5–6.5 mm. Width of head of female 2.5–2.75 mm, of male 2.25–2.5 mm.

Color as in *uhleri* but with males slightly darker and with larger fuscous marks on head and thorax.

General form about as in *uhleri* but proportionately smaller and males slightly more robust. Pronotum of males only slightly longer than crown. Fore wing of female as in *uhleri* but with venation less distinct and anteapical cells usually not apparent. Fore wing of male as in *uhleri* but shorter, extending to tip of abdomen.

Posterior margin of seventh sternite of female as in *uhleri* but with lateral angles more produced. Pygofer processes of male as in *uhleri*. Aedeagus without numerous setae on distal portion. Style similar to that of *uhleri* but with the dorsal terminal projection more slender and more strongly hooked and the toothlike projection near the apex more prominent and somewhat hooked. There is some variation in the shape of the distal portion of the style in both *uhleri* and *nuda*, but in general *nuda* has this part broader and shorter with respect to the shaft of the style than does *uhleri*.

*Type locality*.—Los Angeles County, Calif.

*Type and paratypes*.—U.S.N.M. no. 52226.

*Paratypes*.—In collection of E. D. Ball.

*Remarks*.—Described from 13 specimens as follows: Holotype male, allotype female, and two male paratypes from the type locality, Coquillett collector; three male paratypes from Los Angeles, Calif., Uhler collection; three male paratypes and one female paratype labeled "California" from the collections of Uhler and Coquillett; and one male and one female paratype from Ontario, Calif., April 21, 1908, E. D. Ball.

*Distribution*.—This species appears to be limited to southern California. In addition to the types there are specimens at hand from San Diego, Mint Canyon, Saugus, Cajon Pass, Warner Springs, and San Jacinto Mountains.

SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1938

No. 3037

A NEW GENUS AND TWO NEW SPECIES OF THE DIP-  
TEROUS FAMILY PHORIDAE

By CHARLES T. GREENE

SPECIES of Phoridae exhibit considerable variation in habit. Some are known to develop upon carrion, upon dead and decaying snails, upon dead insects of various orders, and upon decaying vegetable matter. Two species are recorded from cocoons of the elm sawfly, *Cimbex americana* Leach, and two others from nests of the wasp *Vespula germanica* (Fabricius), while several species have been collected from exhumed human bodies. The larvae of *Syneura cocciphila* Coquillett have been reported infesting the heads of the cottony cushion scale, *Icerya purchasi* Maskell, and unidentified larvae, thought to be those of a phorid, have been found in the heads of termites. Numerous species are myrmecophilous. Some are said to attack ants directly, as, for example, *Apocephalus coquilletti* Malloch and *A. similis* Malloch, which are recorded as attacking species of *Camponotus*; while others are known to be inquilines or commensals.

The material described in this paper came to the writer recently for identification. Both species were taken in association with certain species of ants, upon which they may be parasitic.

## ATTAMYIA, new genus

Head of medium size; frons with one pair of postantennal bristles; the usual frontal bristles present, except that the middle pair ordinarily located immediately above the postantennal pair are absent. Mesopleuron bare. Wings of usual size; third vein not forked at

tip; first and third veins approximated; first vein entire. Legs rather slender, front and middle femora of equal width, about half as wide as the posterior pair; middle tibiae with spines other than the apical spurs.

This genus looks very much like *Syneura* and runs out near it in Malloch's table of North American Phoridae,<sup>1</sup> but it is distinct and easily separated from that genus by the characters given above.

*Genotype*.—*Attamyia texana*, new species.

**ATTAMYIA TEXANA, new species**

FIGURE 69, *a-d*

*Female*.—Black, dull, dorsum of the thorax with a metallic sheen; abdomen with a bluish-green iridescence; sixth segment twice as long as the fifth, tapering toward the apex and shiny on the apical half. Frons (fig. 69, *a*) slightly wider than long; four strong bristles on each side; upper two at the ends of two transverse rows of four bristles each; postantennal bristles smaller, proclinate, in some specimens cruciate, in others convergent. Antenna (fig. 69, *b*) with first two joints yellow; third joint grayish brown, elongate, more pointed at the apex; arista nearly black; first two joints small, third very slender, with short pubescence. Palpus pale yellow, darker at the tip, each with three or four black spiny bristles. Scutellum dull brownish black with two bristles. Halteres dark brown; base of stem yellow, tip of knob black. Wing (fig. 69, *c*) with the costa ending decidedly short of the middle; fringe short; first section about four times as long as the second; thickening along the anterior costal edge narrow. Ovipositor (fig. 69, *d*) very slender, shiny black, as long as the preceding segment. Legs entirely yellow, slender; posterior femora with a brownish infuscation.

Length, 1.25 to 1.5 mm.

*Type locality*.—Kisatchie National Forest, Provencal, La.

*Type and paratypes*.—U. S. N. M. no. 52287.

*Remarks*.—Twenty-three specimens, all from the type locality, taken in association with *Atta texana* Buckley. One specimen is dated June 29, 1937, the remainder July 13, 1937. Dr. M. R. Smith is the collector.

The following note on the habit of this species is quoted from a letter from Dr. Smith:

"I saw probably 30 to 100 of the parasites flying over the mound and parasitizing ants here and there. I did not have a hand lens, but with my naked eye I could see that the parasite was striking its

<sup>1</sup>Malloch, J. R., The insects of the dipterous family Phoridae in the United States National Museum. Proc. U. S. Nat. Mus., vol. 43, pp. 411-529, 7 pls., 1912.

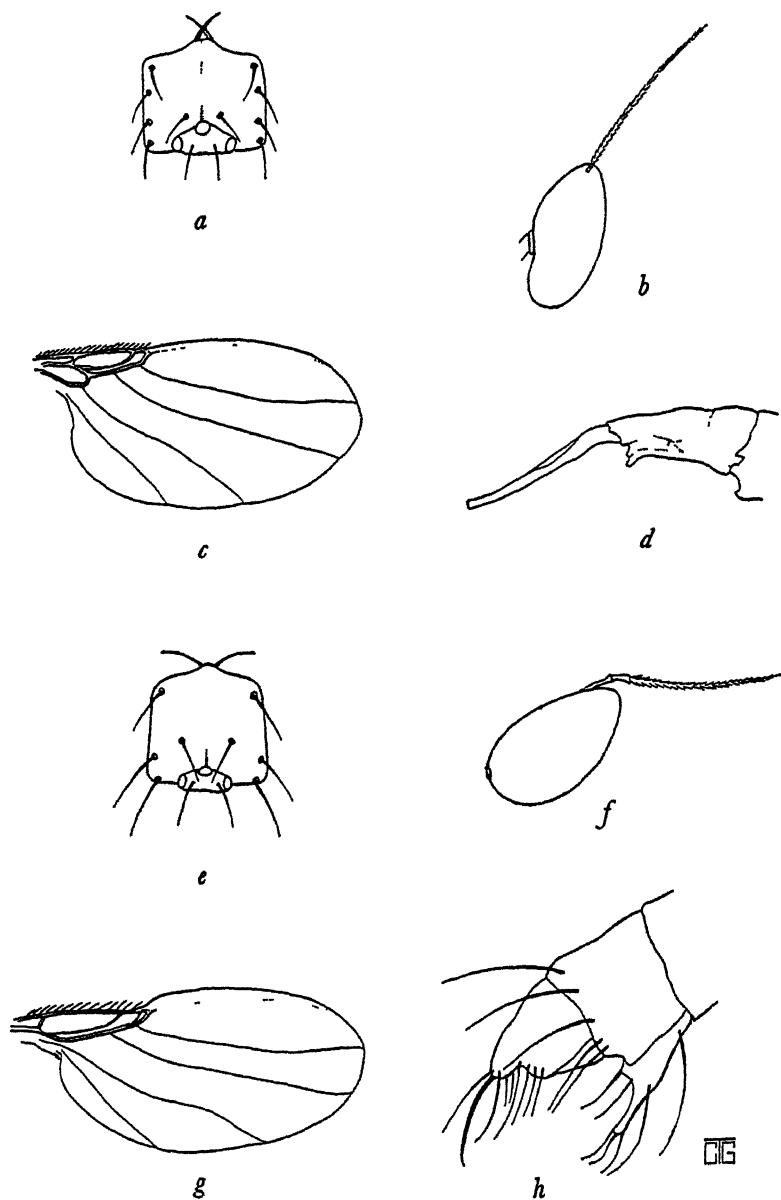


FIGURE 69.—NEW PHORID FLIES

*a-d, Attamyia texana*, new genus and species; *a*, Frons of female; *b*, third joint of female antenna; *c*, wing of female; *d*, ovipositor.

*e-h, Apocephalus coecum*, new species; *e*, Frons of female; *f*, third joint of female antenna; *g*, wing of female; *h*, ovipositor.

victim back of the head. Some of the ants tried to combat the parasite by standing at an angle approximately  $90^{\circ}$  with the ground and opening their mandibles in a threatening manner. The flies were very alert and wary and the ants unable to cope with them. Some of the ants that were struck by the fly stopped, bent their heads downward, and with their front legs attempted to wipe the back of their heads, others that were struck did not seem to be disturbed in the least. All ants attacked kept on working or running around and did not show any immediate ill effects. Apparently a single fly can oviposit a large number of consecutive times (not on the same ant). They hover over the ants and seek a propitious time to strike. The fire ant *Solenopsis xyloni* when struck by the phorid *Apocephalus* (*Plastophora*) *coquilletti* Malloch will fall over on its side or back, seemingly unable to coordinate leg movement, but this is not true of the fungus ant so far as I have observed."

### Genus APOCEPHALUS Coquillett

#### APOCEPHALUS COECUM, new species

##### FIGURE 69, c-h

*Female*.—Black, dull; frons (fig. 69, e) dull, nearly square, with three strong frontal bristles on each side; just above the middle of the front two large bristles, slightly anterior to and forming a transverse row with the middle bristles; ocellar bristles large and forming a straight transverse row with the upper bristles; postantennal bristles as large as the frontals, divergent and slightly reclinate. Antenna (fig. 69, f) yellow; third joint very large, somewhat elliptical, apical end more pointed, with a brownish infuscation; arista a little longer than antenna, first joint slightly longer than second, both tinged with yellow, third joint black, with short pubescence. Palpus pale yellow, with three or four black spiny bristles near the tip. Thorax brownish on dorsum, pleura pale yellow; mesopleuron bare; scutellum darker, with two large bristles; halteres large, stems pale yellow, knobs black. Legs pale yellow, hind femur with a brown infuscation on both sides at the apex, all tarsi blackish. Abdomen with a broad pale area down the middle of the dorsum, nearly white on the first segment, luteous on segments 2 to 5; segments 2 to 5 broadly white along apical edges, broadly black on their sides; sixth segment (fig. 69, h) black, with a very narrow white apical edge and ten large bristles on the posterior margin (the six in the middle the strongest); on the ventral side of the sixth segment a reddish-yellow projection, with large black bristles arranged as in figure 69, h; the apical or genital segment shiny black, with a slight tinge of yellow at the apex, about one and one-half times as long as broad (the length appearing

to vary somewhat, owing to the segment being partly retractile), at the tip two long, very stout spinelike bristles which are parallel from above and curved downward in profile (fig. 69, *h*). Wing (fig. 69, *g*) with the costa decidedly short of the middle, fringe long; first section about four times as long as the second; third section one half as long as second; first vein about one-half as thick as third; thickening along anterior costal edge rather broad and extending almost to tip of fourth vein.

Length, 2.25 to 2.5 mm.

*Type locality*.—Uvalde, Tex.

*Type and paratypes*.—U.S.N.M. no. 52288.

*Remarks*.—Four specimens collected at the type locality on June 16, 1937, by A. W. Lindquist, of the U. S. Bureau of Entomology and Plant Quarantine. A note stating that "the flies were flying over ants (*Eciton coecum* Latreille) in an insectary" accompanied the specimens. This species is most similar to *Apocephalus spinicosta* Malloch, from which it is immediately distinguishable by its darker color and more definite markings.







SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1938

No. 3038

# A NEW GENUS AND TWO NEW SPECIES OF COTTOID FISHES FROM THE ALEUTIAN ISLANDS

By LEONARD P. SCHULTZ

DURING the summer of 1937, O. J. Murie and Victor B. Scheffer collected some fishes for the U. S. Biological Survey while on an expedition to the Aleutian Islands. While identifying these fishes for the Department of Agriculture, I found among them two new cottoids, which are described below.

## PHALLOCOTTUS, new genus

*Genotype*.—*Phallocottus obtusus*, new species.

The characters of the genus are those of the species.

This new genus differs from all other cottoid genera in combining the absence of palatine teeth and the arched lateral line with smooth skin, short, bluntly rounded preopercular spine, gill membranes broadly united and forming a wide free fold across isthmus, anus in anterior third of the distance between insertion of pelvics and origin of anal fin, I, 3 pelvics, among other characters. It is most closely related to the Oligocottinae as defined by Hubbs, 1926,<sup>1</sup> but differs from them in the lack of palatine teeth and the blunt and rounded preopercular spine. The genus *Sigmistes*, upon re-examination of one of the paratypes, shows in a clay impression three teeth at the head of each palatine bone.

<sup>1</sup> Hubbs, Carl L., A revision of the fishes of the subfamily Oligocottinae Occ. Pap. Mus. Zool. Univ. Michigan, No. 171, pp. 1-18, 1926.

## PHALLOCOTTUS OBTUSUS, new species

## FIGURE 70

*Holotype*.—A male specimen 61 mm long to base of rays of caudal fin, collected in a beach seine at Igitkin Island (Aleutian Islands), Alaska, August 9, 1937, by Victor B. Scheffer, original number V. B. S. 109, U.S.N.M. no. 105280. Five paratypes were collected along with the holotype, U.S.N.M. no. 105281.

*Description* (based on the holotype and five paratypes).—The counts and measurements of the holotype are given outside the parentheses and those for each paratype, respectively, are enclosed in the parentheses. All measurements are expressed in hundredths of the standard length. The last two soft rays of dorsal and anal fins, often branching from a common base, were counted as one ray.

Dorsal fin rays XI, 24 (XI, 22; XII, 22; XI, 22; XII, 22; XI, 23); anal fin rays 24 (23, 22, 22, 22, 23); pectoral fin rays 15–15 in all specimens; principal caudal rays 1f (12, 12, 12, 12, 12); number of pores in the lateral line 48 (48, 48, 49, 48, 48); length from tip of snout to base of midcaudal fin rays 61 (53.3, 53, 50.5, 51.2, 47.4) mm; sex ♂ (♂, ♀, ♂, ♂, ♀); greatest depth of body 24.6 (23.6, 27.4, 21.0, 23.2, 23.2); length of head 26.8 (28.1, 29.2, 28.7, 26.4, 27.8); length of snout 8.2 (8.5, 8.1, 8.9, 8.2, 8.0); length of longest soft dorsal ray 12.3 (11.3, 11.3, 13.8, 12.1, 12.5); length of longest spinous dorsal ray 19.7 (19.7, 12.1, 18.2, 15.2, 11.4); length of longest anal fin ray 12.4 (12.4, 10.9, 11.1, 10.7, 9.1); length of longest pectoral fin ray 22.0 (24.4, 23.8, 24.6, 24.0, 26.0); length of longest caudal fin ray 16.7 (16.9, 17.0, 16.4, 17.8, 17.9); length of longest pelvic fin ray 14.5 (15.0, 9.4, 15.2, 14.6, 9.7); interorbital space 9.4 (9.4, 9.3, 9.9, 9.9, 9.7); length of maxillaries 11.1 (12.7, 12.1, 11.3, 11.7, 11.4); least depth of caudal peduncle 6.5 (6.6, 6.6, 6.3, 7.2, 7.0); length of caudal peduncle or the distance from the posterior edge of the base of the last anal fin ray to the base of the midcaudal fin rays 12.3 (14.1, 13.2, 12.7, 15.0, 13.3); diameter of eye 6.5 (6.8, 7.5, 7.5, 7.4, 7.2); distance from tip of snout to origin of anal fin 46.0 (47.0, 52.8, 46.4, 46.3, 47.6); distance from tip of snout to origin of spiny dorsal 28.0 (28.1, 26.4, 27.4, 25.4, 27.0); distance from tip of snout to insertion of pelvic fins 29.5 (30.0, 35.8, 30.1, 32.0, 35.2); distance from tip of snout to middle of vent or midbase of anal papillae 36.2 (34.1, 39.6, 34.3, 38.3, 38.2).

Gill membranes broadly joined to each other, forming a broad free fold across the isthmus; preopercular spine at upper angle of the bone short, blunt, or rounded, not hooked upward as in *Sigmistes*; interorbital space wide, slightly convex; nasal spines concealed, not at all projecting; small sharp teeth present in bands on jaws and vomer, none on palatines; body compressed, deep; skin smooth; lat-

eral line complete, arched over pectoral fin as in *Sigmistes caulias*; no slit behind last gill; anal papillae of male simple, long, conical, unbranched at tip; vent about one-fourth to one-third the distance from the insertion of the pelvic fins to the origin of the anal fin; pelvic fin rays I, 3; one bannerlike cirrus on tip of each dorsal spine except the first; a single unbranched cirrus at each pore of anterior portion of the arch of lateral line, the last cirrus being about under the origin of soft dorsal; a pair of simple dermal cirri over each concealed nasal spine; a large multibranched cirrus over each eye, and another pair of simple unbranched cirri occurs on the occiput about one-third of the distance from those over the eyes to the origin of the spiny dorsal fin; jaws about the same length; snout blunt; spinous dorsal of mature males much higher than on females.

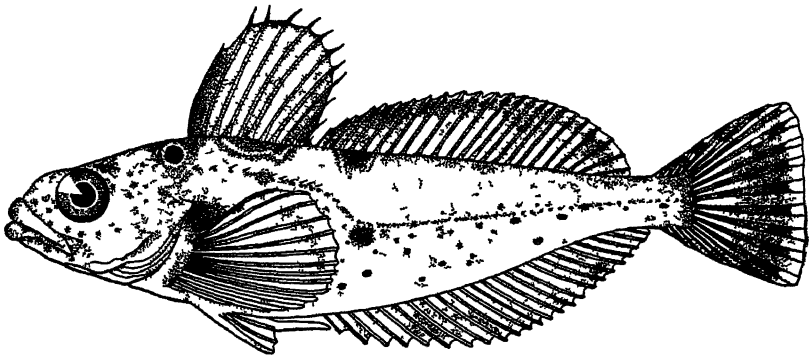


FIGURE 70—*Phallocottus obtusus*, new genus and species. Holotype, U S N M no 105280. Drawn by Jane Roller

Color in alcohol, pale yellowish below, darker above; body finely speckled with tiny black dots, more dense on upper portions of body; anal fin of male yellow-orange; spinous dorsal fin of male blackish anteriorly and brownish orange posteriorly; lower portion of pectorals of male yellowish orange; fins otherwise light grayish; soft dorsal with four or five faint and very irregular cross bars; several ocelli or black spots surrounded by light areas occur on top of head and body as follows: One on top of head midway between eyes; one on midline of occiput; a pair on upper side of head a little in front of origin of soft dorsal, or just above the anterior end of the lateral line; and several faint irregular ones below the lateral line on side of body sometimes absent. Black spots occur as follows: One above upper edge of base of pectoral fin, and one at base of midrays of pectoral fin; another at base of fourth, fifth, or sixth soft dorsal rays; another series of small faint irregular spots occur along the lateral line; two of the paratypes have a row of roundish light areas

just below the lateral line, sometimes their centers are somewhat pigmented; caudal fin barred; anal fin plain whitish to grayish on females.

This species differs from other cottids in combining the absence of palatine teeth, the arched lateral line, pelvics I, 3, with smooth skin, bluntly rounded preopercular spine, anus just behind pelvic insertion, dorsal rays XI or XII, 22 to 24; anal rays 22 to 24.

Named in reference to the large conical anal papillae and the bluntly rounded preopercular spine.

### Genus SIGMISTES Rutter

#### SIGMISTES SMITHI, new species

*Holotype*.—A male specimen 37.5 mm long to base of rays of caudal fin, collected in a beach seine at Igitkin Island (Aleutian Islands), Alaska, August 9, 1937, by Victor B. Scheffer, original number V. B. S. 109, U.S.N.M. no. 105282. Two paratypes were collected along with the holotype, U.S.N.M. no. 105283.

*Description* (based on the holotype and paratypes).—The counts and measurements of the holotype are given outside the parentheses and those for the two paratypes, respectively, are enclosed in the parentheses. All measurements are expressed in hundredths of the standard length. The last two soft rays of dorsal and anal fins, often branching from a common base, were counted as one ray.

Dorsal fin rays X, 24 (X, 24, X, 24); anal fin rays 17 (19, 18); pectoral fin rays 14–14 in all specimens; principal caudal fin rays 12 (12, 12); number of pores in the lateral line 46 (46, 45); length from tip of snout to base of midcaudal fin rays 37.5 (31.5, 29.0) mm; sex ♂ (♂, ♀); greatest depth of body 26.7 (28.5, 25.8); length of head 28.3 (30.4, 29.6); length of snout 8.3 (9.2, 7.9); length of longest soft dorsal fin ray 16.0 (15.5, 14.5); length of longest spinous dorsal ray 12.0 (12.7, 13.8); length of longest anal fin ray 11.2 (12.4, 12.1); length of longest pectoral fin ray 28.0 (28.6, 28.9); length of longest caudal fin ray 20.0 (23.8, 22.6); length of longest pelvic fin ray 13.3 (15.3, 12.8); interorbital space 6.7 (6.3, 6.9); length of maxillaries 12.0 (12.7, 11.0); least depth of caudal peduncle 6.7 (6.3, 6.2); length of caudal peduncle 16.0 (14.3, 14.5); diameter of eye 7.7 (8.3, 8.3); distance from tip of snout to origin of anal fin 51.1 (51.5, 48.3); distance from tip of snout to origin of spinous dorsal fin 28.0 (28.6, 28.0); distance from tip of snout to insertion of pelvic fins 33.4 (35.0, 32.7); distance from tip of snout to middle of vent or midbase of the anal papillae 40.0 (42.6, 38.6).

Gill membranes broadly joined to each other and forming a broad free fold across the isthmus; preopercular spine at upper angle of bone, simple, short, and hooked upward; interorbital space shallowly

concave; nasal spines prominent with a pair of tentacles on each spine; teeth present on vomer, none on the palatines or possibly one very weak tooth; body compressed, deep; skin smooth; lateral line complete, with about 45 or 46 pores, and arched over the pectoral fin; no slit behind last gill; anal papillae large, conical, without horns at tip; vent in anterior portion of middle third of distance from pelvic fins to the origin of the anal fin; pelvic fin rays I, 3; bannerlike cirri on tips of spinous dorsal rays; one unbranched cirrus at each pore of arch of lateral line, no cirri posteriorly; one pair of cirri on each nasal spine, the inner cirrus the largest; a pair of branched dermal cirri over the eyes; another pair, unbranched, on occiput, about half way from eye to origin of dorsal; a third pair about one-third the distance back between the second pair and origin of dorsal; no other cirri on head; nostrils tubular; lower jaw slightly shorter than upper jaw.

Color in alcohol, pale yellowish, the body and head finely speckled with tiny black dots, denser above, lighter below; a faint blackish line extends from the last occipital tentacle forward and downward toward upper edge of pupil; in front of eye is a faint blackish band about as wide as one-half the diameter of the eye, with a light streak through the middle of the band and including the anterior nostril; this darkish band continues on to the tip of the snout; dorsal fin slightly darker grayish than body, more intense near tips of rays; there is a grayish spot about the size of the pupil at the base of the seventh, eighth, or ninth soft dorsal ray; one at the twelfth or fourteenth, and sometimes another at the sixteenth or nineteenth; a large grayish blotch occurs on the upper side of the caudal peduncle at the rear end of the dorsal fin; color plain without any trace of vertical bars on body or fins.

*Sigmistes smithi* differs from the only other member of the genus, *Sigmistes caulias* Rutter,<sup>2</sup> in having X, 24 dorsal fin rays and 17 to 19 anal fin rays instead of IX, 19 to 21 dorsal rays and 14 or 15 anal rays, respectively, and a different color pattern.

Named for Dr. Hugh M. Smith, in honor of his numerous valuable contributions in ichthyology made over a long period of years.

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<sup>2</sup> Rutter, C. M., in Jordan and Evermann, U. S. Nat. Mus. Bull. 47, pt. 3, pp. 2863-2864, 1898.





SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington : 1938

No. 3039

## THE CUBAN OPERCULATE LAND SHELLS OF THE SUBFAMILY CHONDROPOMINAE

By CARLOS DE LA TORRE and PAUL BARTSCH

### INTRODUCTION

IN ALL the world there is no place of equivalent area that has a greater number of species and races of land shells than the Island of Cuba. It is a veritable paradise for the lover of mollusks, for we find not only a numerical preponderance but also beauty of outline and coloration rivaling the faunas of the Philippine and Hawaiian Islands.

The interesting features presented by this fauna are not restricted in appeal to the systematic zoologists—taxonomists—for here the student of genetics and heredity also will find a veritable laboratory teeming with an endless number of problems inviting solution.

In Pinar del Rio Province, in western Cuba, the Organ Mountains, because they are broken up into isolated blocks and by the even greater cutting up of the lateral folds to the north and south, now largely represented by the series of mogotes—hills—of varying size into which the teeth of time have cut them, show splendidly in their faunas the effects of isolation and inbreeding, resulting in an almost endless array of races, each confined to a limestone cliff, which may vary in size from a barn door to miles in extent.

To such restricted habitats most of the members of the subfamily Chondropominae are more firmly wedded today than they would be if they occupied equally distant islands, from which they might be carried by currents or waves to neighboring shores, for grassy intervals present a greater barrier to these calciphil dwellers than would the open sea. As we see it, there are only two agencies at present that might serve as carriers from place to place, wind and birds,



neither of which would seem to be effective in the transportation of members of the groups under discussion, which we believe are largely segregation products of a once continuous widely spread fauna.

Western Cuba was subjected to many vicissitudes during Tertiary times and even during the yesterdays of the Pleistocene, for vacillating ocean levels from time to time changed this end of the island from a continuous land mass to an archipelago of islands, eliminating the lowland faunas and confining the survivors to the influence of their restricted island habitats. All of which presents a fascinating history that our studies are slowly revealing.

We shall have occasion to call attention to some of these problems under the diverse groups here presented and discussed.

These Cuban mollusks have received the attention of many of the naturalists who have visited the "Pearl of the Antilles," or discussed its faunas from the days of Humboldt and Bonpland to date. Their listing displays such names as Sagra, d'Orbigny, Pfeiffer, Gundlach, Otto, Wright, Poey, Gould, Arango, Morelet, Sagebien, Henderson, Simpson, Clapp, Pilsbry, Barbour, Miner, Welch, Lowe, Allen, Clench, Rehder, Hermano León, Father Roca, and de la Torre and his students, among them especially Rodriguez, Aguayo, Ramsden, Bermudez, Portuondo, Moreno, and Jaume. To these should also be added a host of de la Torre's friends, too numerous to mention, who have lent a hand in this enterprise, as well as many field men commissioned from time to time by him to explore specific regions in need of investigation.

Looking over the field as a whole we may say that the major discoveries in our field fall to the credit of de la Torre, Gundlach, Pfeiffer, Sagra, Poey, Henderson, and Bartsch, the efforts of Torre, Henderson, and Bartsch being directed toward the specific exploration and elucidation of the island fauna.

The present paper is a resumption of the studies by Henderson and Bartsch published in 1920, "A Classification of the American Operculate Land Mollusks of the Family Annulariidae."<sup>1</sup> Mr. Henderson's untimely death interrupted this effort, which is now resumed by his devoted friends.

#### Subfamily CHONDROPOMINAE Henderson and Bartsch

1920. Chondropominae HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 59.

Annularid mollusks whose shell ranges in form from turbinate to elongate-conic. The axial sculpture may consist of strong ribs or range from these to slender, almost lamellar riblets, or it may be re-

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<sup>1</sup> Proc. U. S. Nat. Mus., vol. 58, pp. 49-82, 1920.

duced to incremental lines. There is also a wide range of strength in the development of the spiral sculpture, which may be confined to the umbilicus or may cover the entire shell. Breathing devices are present in some groups and absent in others. The chief character of the subfamily, however, is found in the operculum, which consists of a thin, simple chondroid basal plate of several whorls, the outer edge of which may be faintly upturned to form a very fragile, low, slender lamella, suggesting the starting point of the subfamily Adamsiellinae. This is, however, usually soon brushed away, leaving the operculum as a plain plate. The operculum has a deposit of fine calcareous granules which may be very slight or fairly strong, depending upon the species in question.

*Type genus.*—*Chondropoma* Pfeiffer.

#### ARTIFICIAL KEY TO GENERA AND SUBGENERA OF SUBFAMILY CHONDROPOMINAE

Breathing device absent.

Shell turbate..... *Chondropometes* (p. 196)

Shell not turbate.

Shell turreted..... *Turripoma* (p. 251)

Shell not turreted.

Shell elongate-conic..... *Hendersonida* (p. 234)

Shell not elongate-conic.

Shell very broadly ovate..... *Orientipoma* (p. 390)

Shell not very broadly ovate.

Shell ovate.

Junctions of axial ribs and spiral threads forming short cusps.

Axial ribs gathered into tufts at the summit. *Scobinapoma* (p. 237)

Axial ribs not gathered into tufts at the summit.

Outer peristome broadly expanded. *Chondropomartes* (p. 383)

Outer peristome not broadly ex-

panded..... *Chondropomisca* (p. 375)

Junctions of axial ribs and spiral threads not forming short cusps.

Axial ribs gathered into tufts at the summit.

Axial ribs threadlike; sculpture re-

ticulated..... *Chondropomorus* (p. 363)

Axial ribs sublamellar; sculpture

vertebrated..... *Chondropomodes* (p. 361)

Axial ribs not gathered into tufts at the

summit..... *Chondropoma* (p. 322)

Breathing device present.

Breathing device a slit in the parietal wall..... *Chondrothyrium* (p. 395)

Breathing device not a slit but a puncture.

Shell turbate..... *Chondrothyroma* (p. 212)

Shell not turbate.

Shell turreted.

Umbilicus open.

Shell brightly colored..... *Hendersonina* (p. 233)

Shell not brightly colored..... *Turrithyra* (p. 240)

Umbilicus closed..... *Turrithyretes* (p. 240)

Breathing device present—Continued.

Breathing device not a slit but a puncture—Continued.

Shell not turbinate—Continued.

Shell not turreted.

Shell ovate.

Umbilicus open.

Last whorl solute..... *Hendersonoma* (p. 252)

Last whorl not solute.

Inner lip of outer peristome with a plication. *Plicathyra* (p. 263)

Inner lip of outer peristome without a

plication..... *Chondrothyra* (p. 252)

Umbilicus closed.

Inner lip of outer peristome cut..... *Chondrothyretes* (p. 269)

Inner lip of outer peristome not cut but with

a deep pit..... *Foveothyra* (p. 265)

Shell not ovate.

Shell subglobose.

Umbilicus open..... *Plicathyrella* (p. 306)

Umbilicus closed..... *Chondrothyrella* (p. 306)

#### Genus *CHONDROPOMETES* Henderson and Bartsch

1920. *Chondropometes* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 60.

Shell of turbinate form, openly umbilicated, marked by axial and spiral threads. Lip simple or double. Breathing pore present or absent. Operculum subcircular, multispiral with the inner part of the whorls covered with a heavy calcareous calluslike deposit.

Type: *Chondropometes* (*Chondropometes*) *vignalense* (Wright) Pfeiffer.

In 1920<sup>2</sup> Henderson and Bartsch created the subgenus *Chondropometes*, making it a subdivision of *Chondropoma*. They likewise founded the subgenus *Chondrothyroma*,<sup>2</sup> placing this under their genus *Chondrothyra*. The finding of specimens of *Chondropometes* (*Chondrothyroma*) *scopulorum perplexum* and *C. (C.) magnum magnum* without breathing pore, leads us to make the following re-alignment, which we believe to be phylogenetically and zoogeographically more sound.

#### KEY TO THE SUBGENERA OF GENUS *CHONDROPOMETES*

Breathing pore present..... *Chondrothyroma* (p. 212)

Breathing pore absent..... *Chondropometes* (p. 196)

#### Subgenus *CHONDROPOMETES* Henderson and Bartsch

1920. *Chondropometes* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 60.

*Chondropometes* without breathing pore.

Type: *Chondropometes* (*Chondropometes*) *vignalense* (Wright) Pfeiffer.

<sup>2</sup>Proc. U. S. Nat. Mus., vol. 58, p. 63, 1920.

## KEY TO THE SPECIES OF SUBGENUS CHONDROPOMETES

- Peristome broadly expanded..... latilabre  
 Peristome not broadly expanded.  
     Peristome only moderately expanded..... torrei  
     Peristome not moderately expanded.  
         Peristome only very slightly expanded..... vignalense

## CHONDROPOMETES (CHONDROPOMETES) LATILABRE (Orbigny)

## PLATE 8, FIG. 1

1845. *Cyclostoma latilabris* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'île de Cuba*, vol. 1, pp. 255-256, pl. 21, fig. 12.

Shell turbinate, flesh-colored, pale horn colored, pale brown, or sometimes rather dark purplish brown; in the dark phase the color becomes intensified on the last whorl behind the peristome. Nuclear whorls 2, forming a somewhat truncated apex, the early portions minutely microscopically granulose, the last portion of the last turn with indications of closely approximated feeble axial threads. Post-nuclear whorls inflated, strongly rounded, marked by slender sublamellar, decidedly retractively curved axial riblets; those on the last whorl being a little more distantly spaced than the rest. In addition to this, the early whorls show slender spiral threads, which become enfeebled on the later turns but are present even on the last portion of the last turn. The junction of these spiral threads with the axial riblets renders these somewhat sinuous and somewhat thickened at their junction. Periphery of the last whorl well rounded. Base strongly inflated, well rounded, openly umbilicated, marked by the continuations of the axial riblets and rather feeble spiral threads. This stronger spiral sculpture extends to the outer limit of the umbilicus. The last whorl is solute for about one-fifteenth of a turn. Aperture somewhat irregularly broadly ovate; peristome double, the inner slightly expanded and thickened, the outer very broadly expanded and reflected, not all in one plane, but somewhat wavy. The expanded portion is almost of the same width all the way around. It is adnate to the preceding turn on the parietal wall, while the reflected portion projects over a little more than half the umbilicus on the columellar border. The peristome is yellowish white, while the inside of the aperture is pale brown. Operculum paucispiral with subcentral nucleus, covered with a thin granular deposit excepting a broad border at the edge.

The specimens described and figured, U.S.N.M. no. 354923, are part of a lot of 62 that we collected on the Tomas Barrera Expedition in 1914, when we found this species to extend from San Juan de Sagua at the western end of Pan de Guajaibon to the middle of its northern slope.

## CHONDROPOMETES (CHONDROPOMETES) TORREI Bartsch

Shell rather large, turbinate, thin, semitranslucent, openly umbilicate, varying in color from pale buff through yellow to orange-buff to brown, unicolor or with a dark vertical band behind the peristome, with or without spiral bands. Peristome expanded and reflected, about half as wide as that of *C. (C.) latilabre* (d'Orbigny). Nuclear whorls about 2, in perfect conformity in their coiling with the post-nuclear turns. The first is thin, translucent, appearing finely granulose under high magnification; the last marked by feeble, somewhat retractively slanting, closely spaced, incremental lines. Postnuclear whorls inflated, well rounded, marked by very regular, retractively slanting, sublamellar axial riblets, which are a little less wide than the spaces that separate them. In addition to these, there are narrow varicial streaks at more or less regular intervals. These may be lighter or darker than the general tone of the shell. They are the result of the approximation of two or more axial riblets. The spiral sculpture consists of quite regularly spaced threads which are separated by spaces a little wider than the threads. These threads at their junction with the axial ribs render these slightly wavy, and under high magnification give a somewhat serrated aspect to them. The spiral sculpture is very variable in strength, ranging from obsolete to quite pronounced. Suture well impressed; periphery inflated, well rounded. Base inflated, well rounded, marked like the spire. Axial riblets extend over the wall of the umbilicus, becoming usually a little stronger within. The spiral sculpture within the umbilicus consists of much stronger threads than those on the spire. The last whorl in adult shells is solute for some little distance. The outside of the parietal wall here shows the continuation of the axial riblets. Aperture subcircular, slightly angulated at the posterior angle. Operculum thin, multispiral, horny, with a fine, granulose, calluslike deposit, which is heaviest on the inner margin and thins out outwardly, vanishing a little beyond the middle of the turn. This deposit is laid down in more or less of a corrugated pattern.

The animal of *C. (C.) torrei minnaense* has the sides smoky gray. The top of the forehead and back are darker; the tips of the snout are pale buff and the tentacles bright orange, slightly paler at the slightly expanded tip, sole of the foot pale smoky gray. Sole of foot medially longitudinally cleft; locomotion of the two sides alternate. When at rest the animal suspends itself by a mucous thread. That of *C. (C.) t. collumelare* has the dorsal part of the animal smoky gray; sides paler. Sole of foot flesh-color, with a smoky suffusion. Tentacles orange-red, with the expanded distal portion dark smoke gray. Snout smoke gray, with the tip flesh-colored with a smoky suffusion.

This species is known from the Sierra San Andrés, the Sierra Guacamayas, and the Sierra Galalón, also from certain mogotes south and west of these limestone blocks. All the members are cave or cavity dwellers and very restricted in their distribution for that reason. They are nocturnal in their habits and suspend themselves in the day-time by a mucous thread from the roof of the cavity that they occupy. In these isolated places characters peculiar to each have been developed, and to these we are assigning subspecific rank. Sixteen of these subspecies are known at present. The several outstanding characteristics of each are taken cognizance of in the following key and the brief descriptions that follow. The descriptions are listed in west-eastward geographic order.

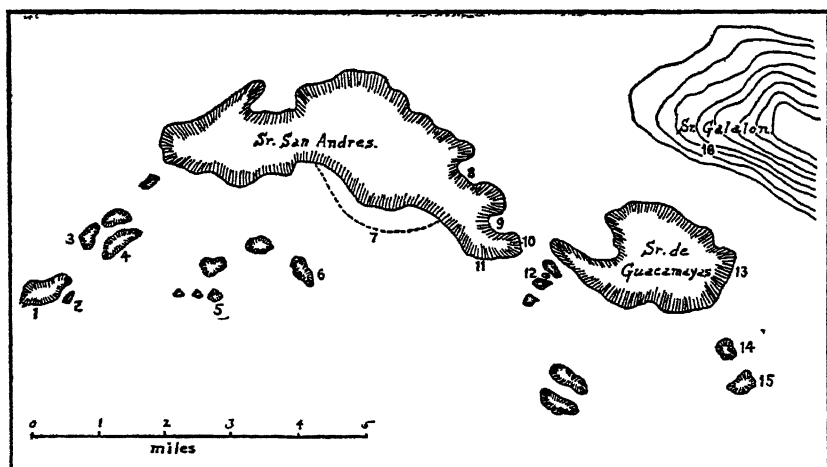


FIGURE 71.—Distribution of the subspecies of *Chondropometes* (*Chondropometes*) *torrei*: (1) *minaense*; (2) *rinconadense*; (3) *jaguaense*; (4) *antoniense*; (5) *antonitense*; (6) *torrei*; (7) *cingulatum*; (8) *iosaturatum*; (9) *collumelare*; (10) *luteilabre*; (11) *flammilabre*; (12) *affine*; (13) *gratiosum*; (14) *flavidum*; (15) *pallidulum*; (16) *alveare*.

Here also it should be stated that while we usually refer only to the type, the conclusions expressed in our statements are not based on this specimen only but are usually founded on a considerable series of individuals in the collection of the United States National Museum and that of Dr. Carlos de la Torre.

Distribution of the subspecies of *C. (C.) torrei* is shown in figure 71.

#### KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROPOMETES) TORREI

Peristome red.

Shell without spiral color bands..... *torrei*

Shell with interrupted spiral color bands.

Interrupted spiral bands rather strong..... *antonitense*

Interrupted spiral bands rather feeble..... *flammilabre*

Peristome yellow or flesh-color.

Shell with spiral bands.

Spiral bands conspicuous.

Dark axial zone behind peristome very decided.

Peristome orange----- cingulatum

Peristome flesh-color----- affine

Dark axial zone behind peristome not decided.

Peristome yellow----- flavidum

Peristome flesh-color----- pallidulum

Spiral bands not conspicuous.

Greater diameter more than 20 mm.

General color clouded, pale.

Spiral banding confined to periphery----- alveare

Spiral banding not confined to periphery----- luteilabre

General color not clouded, dark.

Greater diameter more than 23 mm.

Penultimate whorl dark brown----- iosaturatum

Penultimate whorl pale brown----- jaguaense

Greater diameter less than 22 mm.

Spiral markings on early postnuclear

whorls conspicuous----- minaense

Spiral markings on early postnuclear

whorls inconspicuous----- collumelare

Greater diameter less than 16 mm----- gratiosum

Shell without spiral bands.

Diameter more than 24 mm----- antoniense

Diameter less than 22 mm----- rinconadense

#### CHONDROPOMETES (CHONDROPOMETES) TORREI TORREI Bartsch

##### PLATE 9, FIGURE 8

1937. *Chondropometes* (*Chondropometes*) *torrei* BARTSCH, Journ. Washington Acad. Sci., vol. 27, pp. 130-131, fig. 2.

This is the most brilliantly colored of the subspecies. It is characterized by its orange-buff color, with darker orange varicial streaks and flame-colored peristome. It comes from Abra de Bejarano, Mogote Canalete, south of the Sierra San Andrés.

The type, U.S.N.M. no. 428794, is a complete specimen having 6 whorls, and measures: Length, 23.0 mm; greater diameter, 22.3 mm; lesser diameter, 15.9 mm.

#### CHONDROPOMETES (CHONDROPOMETES) TORREI ANTONITENSE, new subspecies

##### PLATE 8, FIGURE 9

Shell small, pale iodine brown, with flame-colored peristome, conspicuously banded with continuous brown bands of deeper shade than the general tone of the shell. This small race comes from Hoyo Corto de San Antonio.

The type, U.S.N.M. no. 428798, has 4.9 whorls remaining and measures: Length, 19.7 mm; greater diameter, 18.4 mm; lesser diameter, 13.8 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI FLAMMILABRE, new subspecies****PLATE 8, FIGURE 6**

Shell of medium size, dark iodine brown, with slightly paler varicial streaks and spiral bands, which are of a slightly deeper shade than the general coloration but quite inconspicuous. The peristome is flame-color.

The specimens before us were collected at Pico Grande, Sierra de San Andrés. It extends west to Zumbido, in the same range.

The type, U.S.N.M. no. 428796, has 3.5 whorls remaining and measures: Length, 21.5 mm; greater diameter, 19.9 mm; lesser diameter, 15.3 mm.

This subspecies suggests *C. (C.) torrei iosaturatum*, from which it can be distinguished at once by its brilliantly colored peristome.

**CHONDROPOMETES (CHONDROPOMETES) TORREI CINGULATUM, new subspecies****PLATE 9, FIGURE 4**

In this race the shell is of flesh-colored ground coloring, conspicuously marked by broad spiral bands of brown. There is also a very broad dark purplish-brown area immediately behind the peristome. The latter is buff. The type comes from the Ensenada de la Ayua, but the race extends east from there to the Ensenada Zumbido, in the Sierra de San Andrés.

The type, U.S.N.M. no. 428793, has almost 4 whorls remaining and measures: Length, 22.4 mm; greater diameter, 28.8 mm; lesser diameter, 14.7 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI AFFINE, new subspecies****PLATE 10, FIGURE 1**

Shell similar to *C. (C.) torrei cingulatum* but smaller and paler, having the axial dark zone behind the peristome even more strongly expressed and the peristome flesh-color, not yellow.

This race was collected by Natenson on the second mogote south of the west end of the Sierra Guacamayas.

The type, U.S.N.M. no. 468920, is an almost complete specimen, having lost about half of the first turn; the 4.9 whorls remaining measure: Length, 21.5 mm; greater diameter, 19.0 mm; lesser diameter, 15.1 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI FLAVIDUM, new subspecies****PLATE 9, FIGURE 6**

Shell similar to *C. (C.) torrei affine* but with the dark axial zone behind the peristome very faintly expressed and the peristome yellow.



This race was collected by Natenson on the mogote between the southeast end of the Sierra Guacamayas and Mogote Largo, to the south of this.

The type, U.S.N.M. no. 468922, is an almost complete specimen, having lost probably the first half turn. The 5.1 whorls remaining measure: Length, 22.0 mm; greater diameter, 20.2 mm; lesser diameter, 15.5 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI PALLIDULUM, new subspecies**

PLATE 9, FIGURE 1

Shell similar to *C. (C.) torrei flavidum* but with less yellow in the general coloration and with the peristome flesh-color. The dark axial zone behind the peristome is poorly expressed.

This race was collected by Natenson on Mogote Largo, which is the second mogote southwest of Pico Chico in the Sierra Guacamayas.

The type, U.S.N.M. no. 468924, is a complete specimen, having 6.0 whorls and measuring: Length, 23.1 mm; greater diameter, 20.8 mm; lesser diameter, 15.5 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI ALVEARE, new subspecies**

PLATE 10, FIGURE 2

This subspecies closely resembles *C. (C.) torrei luteilabre* but is paler than that race and has the spiral banding practically always confined to the peripheral region, where it usually constitutes an inconspicuous interrupted spiral band. Occasionally there is a mere indication of additional bands, but the shell never bears as many bands as in *C. (C.) torrei luteilabre*.

The type, U.S.N.M. no. 468756, comes from Mogote Colmena de Piedra, which is the southwestern part of the Sierra Galalón. This is a complete specimen having 6.0 whorls and measuring: Length, 23.2 mm; greater diameter, 21.8 mm; lesser diameter, 15.8 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI LUTEILABRE, new subspecies**

PLATE 10, FIGURE 6

Shell small, very pale yellow with a broad axial area of dark iodine purple a little distance behind the peristome. The shell also has pale bands of brown, which extend upon the peristome, which is pale yellow.

This subspecies comes from the Puerto del San Andrés, that is, the extreme eastern end of the Sierra.

The type, U.S.N.M. no. 428797, has 3.8 whorls remaining and measures: Length, 18.9 mm; greater diameter, 19.1 mm; lesser diameter, 15.4 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI IOSATURATUM, new subspecies**

PLATE 10, FIGURE 8

Shell rather large, iodine brown, more intense immediately behind the peristome, which is yellow. Inconspicuous bands of darker brown are also present, which are strongly marked on the inner half of the back of the expanded peristome.

The specimens before us were collected at Sitio de la Sierra de San Andrés by Father Roca and Bermudez.

The type, U.S.N.M. no. 367735, has 4 whorls remaining and measures: Length, 24.9 mm; greater diameter, 23.5 mm; lesser diameter, 17.2 mm.

The large size and paler peristome distinguish this from *C. (C.) torrei flammilabre*.

**CHONDROPOMETES (CHONDROPOMETES) TORREI JAGUAENSE, new subspecies**

PLATE 9, FIGURE 5

Very similar to *C. (C.) torrei luteilabre* but larger and with much finer and more closely spaced axial sculpture.

The type, U.S.N.M. no. 468720, comes from La Jagua, Consolación del Norte. It has 3.7 whorls remaining and measures: Length, 22.3 mm; greater diameter, 23.4 mm; lesser diameter, 15.3 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI MINAENSE, new subspecies**

PLATE 9, FIGURE 7

This subspecies ranges from pale brown to pale iodine color, with the peristome always pale yellow. In the darker forms the area behind the peristome is of deeper coloration than the rest. The nuclear whorls are pale and the early postnuclear whorls dark, while the penultimate whorl is paler and the last turn behind the aperture again matches the early postnuclear whorls. Inconspicuous spiral bands are present.

This race comes from Mogote Mina.

The type, U.S.N.M. no. 354917, is a complete specimen, having 6 whorls and measuring: Length, 23.3 mm; greater diameter, 20.6 mm; lesser diameter, 16.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI COLLUMELARE, new subspecies**

## PLATE 9, FIGURE 3

This shell resembles *C. (C.) torrei minaense* but is more strongly spirally banded, the bands usually also being broader, sometimes being very wide. It differs from this markedly by its much smaller size. From *C. (C.) torrei iosaturatum* it is readily distinguished also by its smaller size and much stronger banding.

The type, U.S.N.M. no. 468833, was collected by Collmillo de la Vieja on the northeast side of the Sierra Guacamayas. It is an almost complete specimen having 5.0 whorls remaining and measuring: Length, 21.1 mm; greater diameter, 19.3 mm; lesser diameter, 14.8 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI GRATIOSUM, new subspecies**

## PLATE 8, FIGURE 3

This race in coloring resembles *C. (C.) torrei luteilabre*, from which its diminutive size at once distinguishes it. It is the smallest known subspecies of *C. (C.) torrei*.

The type, U.S.N.M. no. 468719, is a complete specimen having 5.4 whorls and measuring: Length, 16.0 mm; greater diameter, 15.0 mm; lesser diameter, 11.5 mm. It comes from Pinalito in the southwestern part of the Sierra de Galalón.

**CHONDROPOMETES (CHONDROPOMETES) TORREI ANTONIENSE, new subspecies**

## PLATE 10, FIGURE 7

Shell large, very pale yellow, with the parietal wall of the umbilicus buff, which is also the color of the peristome at this place.

This large subspecies comes from Mogote de la Jagua.

The type, U.S.N.M. no. 354919, has 3.7 whorls remaining and measures: Length, 24.3 mm; greater diameter, 24.7 mm; lesser diameter, 17.8 mm.

**CHONDROPOMETES (CHONDROPOMETES) TORREI RINCONADENSE, new subspecies**

## PLATE 9, FIGURE 2

This race, which comes from the small mogote known as Rinconada, close by Mogote de la Mina, is pale yellow with almost white lip.

The type, U.S.N.M. no. 468846, a complete specimen, has 5.6 whorls and measures: Length, 22.5 mm; greater diameter, 20.3 mm; lesser diameter, 15.4 mm.

## CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE (Wright) Pfeiffer

Shell rather large, turbinate, thin, semitranslucent, openly umbilicated, varying in color from plain ground-glass white through horn-color to brown or even purplish, unicolor or marked with interrupted spiral bands. Nuclear whorls 2 or more, strongly rounded, forming a somewhat truncated apex, the first half strongly granulose, the next turn minutely granulose, while the last half of the last turn shows faint indications of the beginnings of the axial threads, which become stronger as the shell increases in size and eventually merge into the postnuclear axial sculpture. Postnuclear whorls inflated, strongly rounded with the summit roundly shouldered, marked by retractively curved, closely spaced, sublamellar axial riblets, which are rendered wavy by the weakly developed spiral cords. At irregular intervals the axial riblets are more closely approximated than the succeeding or preceding ones, which lends the whorls a somewhat scalariform pattern. Suture strongly constricted. Periphery of the last whorl strongly rounded; base inflated, strongly rounded, openly broadly umbilicated, marked by the continuation of the axial ribs and spiral threads, the latter becoming usually more intensified on the umbilical wall within the umbilicus. The last whorl in adult shells is usually solute for some little distance; the outside of the parietal wall being there marked by the continuation of the axial ribs. Aperture varying from very broadly oval to sub-circular with a slight angulation at the posterior angle. The peristome is very narrowly expanded and reflected. The operculum is thin, multispiral, horny with a fine granulose, calluslike deposit which is heaviest on the inner margin and thins out, vanishing about the middle or a little beyond the middle of the whorls. This deposit is present in more or less wavy or threadlike depositions and lends to the outer surface of the operculum a slightly corrugated pattern.

The animal of *Chondropometes (Chondropometes) vignalense* is rather short and has the sole of the foot divided by a median longitudinal cleft, the locomotion being effected alternately by the two sides. The tentacles are slightly expanded laterally near the tip.

In *C. (C.) vignalense vignalense* the body is pale smoky gray on the sides. Forehead and top of the body darker. Sole of the foot flesh-color, with smoky suffusion, which is also the color of the snout. Tentacles smoky gray at base, gradually changing to yellowish-olive toward the tip. This is also the color of *C. (C.) vignalense clappi*.

The animal of *C. (C.) vignalense puertecitense* may be described as follows: Flesh-color, with a smoky-gray tinge. Tip of the head, snout, and basal half of the tentacles bluish smoky gray, the snout portion having a brownish flush. The tip of the tentacles is olive-

green, a little darker at the expanded distal portion. The edge of the snout is flesh-color. Sole of the foot flesh-color. The internal anatomy behind and between the tentacles appears pinkish and shines through the substance of the tissue.

Of the animal of *C. (C.) vignalense fogonense* we have taken the following notes: Flesh-color, with a smoky suffusion; base of tentacles, forehead, and snout ashy gray. The distal portion of the tentacles is pale orange in color, not expanded at the tip; edge of snout paler than the region behind it. When resting the animal suspends itself by a mucous thread.

Distribution of the subspecies of *C. (C.) vignalense* is shown in figure 72.

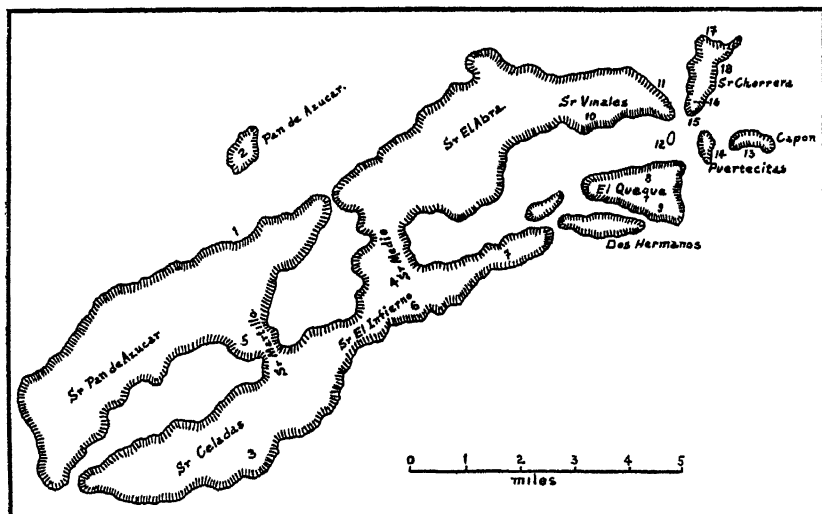


FIGURE 72.—Distribution of the subspecies of *Chondropometes (Chondropometes) vignalense*: (1) *azucarense*; (2) *azucarellum*; (3) *celadense*; (4) *lucifer*; (5) *martillense*; (6) *infernale*; (7) *poenitentis*; (8) *bruneocinctum*; (9) *venerabile*; (10) *ignicolor*; (11) *piadae*; (12) *palmaritense*; (13) *caponense*; (14) *puertecitense*; (15) *vignalense*; (16) *jarucense*; (17) *clappi*; (18) *fogonense*.

KEY TO THE SUBSPECIES OF CHONDROPOMETES (*CHONDROPOMETES*) VIGNALENSE

Shell uniformly ground-glass white.

Greater diameter more than 20 mm..... *clappi*

Greater diameter less than 18 mm..... *vignalense*

Shell not uniformly ground-glass white.

Shell ground-glass white but with a broad pale straw-colored  
axial band a little distance behind the peristome..... *venerabile*

Shell not as above.

Shell pale straw-color.

Dark axial band behind aperture absent..... *puertecitense*

Axial ribs distantly spaced.

Axial ribs closely spaced..... *azucarellum*

- Dark axial band behind aperture present.  
 Dark axial band behind the aperture strong----- fogonense  
 Dark axial band behind the aperture faint.  
 Axial sculpture decidedly lamellose----- caponense  
 Axial sculpture not decidedly lamellose.  
 Axial ribs very closely spaced----- martillense  
 Axial ribs not very closely spaced----- celadense  
 Axial sculpture on spire obsolete----- lucifer
- Shell not pale straw-color.  
 Shell pale brown.  
 Shell not spirally banded.  
 Peristome white----- piadae  
 Peristome buff----- azucarense  
 Peristome red----- ignicolor
- Shell spirally banded.  
 Spiral bands very conspicuous.  
 Greater diameter 23.6 mm----- bruneocinctum  
 Greater diameter 20 mm----- poenitentis  
 Spiral bands not very conspicuous.  
 Spiral bands almost continuous----- infernale  
 Spiral bands discontinuous.  
 Axial sculpture sharply lamellose\_\_\_ palmaritense  
 Axial sculpture less sharply lamellose\_\_\_ jarucense

## CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE CLAPPI, new subspecies

## PLATE 7, FIGURE 11

This delicate, thin-shelled, translucent, ground-glass white race comes from the north end of the Sierra de la Chorrera. We gathered more than 100 specimens about the cave from which a small stream issues.

The type, U.S.N.M. no. 428786, is a complete specimen having 6 whorls and measuring: Length, 22.4 mm; greater diameter, 22.0 mm; lesser diameter, 16.0 mm. It is named for Dr. George Clapp, who was a member of the Tomas Barrera Expedition when we obtained most of our specimens.

## CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE VIGNALENSE (Wright) Pfeiffer

## PLATE 7, FIGURE 8

1863. *Chondropoma vignalense* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 10, p. 189.

Wright, in his travels through western Cuba, was the first to make known this species, and he distributed his material under the general label "Vinales." We know from various other species collected by Wright that he gathered material about the southeast end of the Sierra de la Chorrera, and recent collecting here has produced material that is in every way comparable with the specimens in our collection received from Wright. It seems proper, therefore, that the race occu-

pying this end of this limestone block should be considered the type locality of the typical race.

The shells of this race resemble closely *C. (C.) vignalense clappi* in delicacy and color, but they are much smaller.

The specimen figured, U.S.N.M. no. 468679, comes from the southeastern end of the Sierra Chorrera. It is a complete individual, having 5.8 whorls and measuring: Length, 18.2 mm; greater diameter, 17.8 mm; lesser diameter, 12.5 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE VENERABILE, new subspecies**

**PLATE 8, FIGURE 11**

This was collected in the Hoyo de los Santos of El Queque. It is of ground-glass white color, with a straw-colored axial band a little behind the peristome.

The type, U.S.N.M. no. 428788, has 3.3 whorls remaining and measures: Length, 21.2 mm; greater diameter, 22.5 mm; lesser diameter, 15.6 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE PUERTECITENSE, new subspecies**

**PLATE 7, FIGURE 9**

Shell very similar to *C. (C.) vignalense vignalense* but pale yellow. This subspecies comes from Mogote Puertecitas off the southeast end of the Chorrera.

The type, U.S.N.M. no. 468680, is a complete specimen having 5.5 whorls and measures: Length, 17.7 mm; greater diameter, 17.2 mm; lesser diameter, 12.7 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE AZUCARELLUM, new subspecies**

**PLATE 7, FIGURE 6**

Shell small, pale yellow, resembling *C. (C.) vignalense puertecitense* in size and coloration but having the axial riblets much more numerous and much more closely spaced.

The type, U.S.N.M. no. 429046, was collected by G. Homer on Mogote Pan de Azucar. It has 2.5 whorls remaining and measures: Length, 16.6 mm; greater diameter, 18.5 mm; lesser diameter, 13.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE FOGONENSE, new subspecies**

**PLATE 8, FIGURE 4**

This subspecies comes from Fogon de los Negros in the northeastern part of de la Chorrera. It is a small race resembling *C. (C.)*

*vignalense puertecitense*, but it can at once be distinguished from this by its having a broad dark smoke-colored axial zone a little behind the peristome.

The type, U.S.N.M. no. 468682, has 4.2 whorls remaining and measures: Length, 17.0 mm; greater diameter, 18.7 mm; lesser diameter, 14.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE CAPONSE, new subspecies**

**PLATE 7, FIGURE 4**

Shell very pale buff, with a pale brown axial band a little behind the peristome, which is pale buff.

The type, U.S.N.M. no. 428792, which comes from Mogote Capon, has 3 whorls remaining and measures: Length, 17.5 mm; greater diameter, 18.9 mm; lesser diameter, 13.7 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE MARTILLENSE, new subspecies**

**PLATE 7, FIGURE 5**

This subspecies comes from the Cueva del Martillo, which is situated in the ridge that connects the Sierra de Chichones with the Sierra de los Celadas and Sierra del Infierno at their junction; it is called Martillo. It is a little darker in color than *C. (C.) vignalense celadense* and has the axial ribs much more closely spaced.

The type, U.S.N.M. no. 468684, is a complete specimen having 5.5 whorls and measuring: Length, 17.0 mm; greater diameter, 17.0 mm; lesser diameter 13.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE CELADENSE, new subspecies**

**PLATE 7, FIGURE 7**

This comes from the Sierra Celadas. The shell is pale straw-colored, but there is an intensification of the color a little behind the peristome, which gives the shell at this place a faintly vertically banded aspect.

The type, U.S.N.M. no. 428799, has a little more than 4 whorls remaining and measures: Length, 17.8 mm; greater diameter, 18.6 mm; lesser diameter, 14.2 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE LUCIFER, new subspecies**

**PLATE 8, FIGURE 2**

This subspecies was also collected by Father Roca; likewise by Aguayo and Bermudez at a much higher altitude than *C. (C.) vignalense infernale*, in the Sierra del Infierno. It is at once distinguished from that subspecies by its much paler color and absence of



spiral banding. It also has a pale buff axial band a little behind the aperture. The axial and spiral sculpture are both much reduced.

The type, U.S.N.M. no. 367734, has 3.5 whorls remaining and measures: Length, 21.4 mm; greater diameter, 24.0 mm; lesser diameter, 14.6 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE PIADAE, new subspecies**

PLATE 7, FIGURE 2

Shell pale brown except the peristome, which is white. There is a slight intensification of the brown color as a pale axial band a little behind the peristome.

The type, U.S.N.M. no. 367730, comes from El Ancon of the Sierra Vinales. It has 3.5 whorls remaining and measures: Length, 21.3 mm; greater diameter, 22.8 mm; lesser diameter, 17.2 mm.

A considerable series of specimens from the east side of the Sierra Vinales agree splendidly with the type.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE AZUCARENSE, new subspecies**

PLATE 7, FIGURE 1

This comes from Pan de Azucar. Its color is very pale brown with the peristome buff.

The type, U.S.N.M. no. 354916, we collected on the Tomas Barrera Expedition in 1914 at the base of Pan de Azucar. It has 3.7 whorls remaining and measures: Length, 17.3 mm; greater diameter, 22.1 mm; lesser diameter, 15.8 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE IGNICOLOR, new subspecies**

PLATE 8, FIGURE 10

This subspecies is strikingly colored, its general color being pale orange, while the peristome is reddish orange, almost flame-color.

The type, U.S.N.M. no. 428787, was collected in Hoyo Magdalena in the Costanera de San Vicente, Vinales. It has 3.5 whorls remaining and measures: Length, 22.5 mm; greater diameter, 23.0 mm; lesser diameter, 16.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE BRUNEOCINCTUM, new subspecies**

PLATE 7, FIGURE 10

This subspecies also comes from Sierra Tumbadero, which has been more recently called El Queque, but from another locality than that occupied by *C. (C.) vignalense venerabile*. It ranges from pale brown to darker brown and is marked with slender, somewhat interrupted,

spiral bands of darker brown, which are intensified in definite axial regions to form almost a varicial element. There is also a darker zone of brown a little behind the peristome, the latter being yellowish white.

The type, U.S.N.M. no. 428789, is a perfect specimen having 6.2 whorls and measuring: Length, 23.7 mm; greater diameter, 23.6 mm; lesser diameter, 17.0 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE POENITENTIS, new subspecies**

PLATE 7, FIGURE 3

This subspecies resembles *C. (C.) vignalense bruneocinctum* but is considerably smaller and usually has a decidedly purplish tinge. It appears to range from the mogotes Dos Hermanos to Cuajaní to La Penitencia.

The type, U.S.N.M. no. 468701, was collected at the Cafetal de la Penitencia. The type is a complete specimen, having 6.0 whorls and measuring: Length, 20.0 mm; greater diameter, 20.0 mm; lesser diameter, 15.9 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE INFERNALE, new subspecies**

PLATE 8, FIGURE 7

This exceedingly delicate shell is semitranslucent, of pale brown color, and marked by slender spiral bands, which are almost continuous on the last whorl. The peristome is pale orange.

The type, U.S.N.M. no. 367731, was collected by Father Roca at Sitio del Infierno, southwest of Vinales. It has a little more than 3 whorls remaining and measures: Length, 21.0 mm; greater diameter, 21.9 mm; lesser diameter, 15.3 mm.

**CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE PALMARITENSE, new subspecies**

PLATE 8, FIGURE 5

Shell pale brown with a decidedly darker axial zone a little behind the peristome, which is white. It is obscurely interruptedly spirally banded. These markings, however, have to be looked for or they will be overlooked on account of their faintness.

This subspecies, while resembling *C. (C.) vignalense bruneocinctum*, is readily distinguished from that by its decidedly smaller size and fainter spiral markings.

The type, U.S.N.M. no. 428791, was collected by Bartsch on Mogote Palmarito. It has 3.5 whorls remaining and measures: Length, 16.8 mm; greater diameter, 19.2 mm; lesser diameter, 14.0 mm.

## CHONDROPOMETES (CHONDROPOMETES) VIGNALENSE JARUCENSE, new subspecies

## PLATE 8, FIGURE 8

Shell small, pale brown, with rather distant, inconspicuous, interrupted, pale brown spiral bands. There is also an axial brown zone a little distance behind the yellowish-white peristome, which extends over the parietal wall of the umbilicus.

The type, U.S.N.M. no. 367732, was collected by Father Roca in the Hoyo de Jaruco, a sink located on the high parts of the east side of the Chorrera. It has 3.5 whorls remaining and measures: Length, 17.4 mm; greater diameter, 18.1 mm; lesser diameter, 14.0 mm.

## Subgenus CHONDROTHYROMA Henderson and Bartsch

1920. *Chondrothyroma* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell turbate, openly umbilicate, and marked by axial ribs only, except on the umbilical wall, which shows spiral threads of varying strength in the different races. Breathing pore present on the parietal wall behind the peristome near the posterior angle of the aperture, except in *Chondropometes* (*Chondrothyroma*) *scopulorum perplexum*, and *C. (C.) magnum magnum* in which the pore is sometimes absent. Aperture subcircular; peristome broadly expanded and reflected, marked by concentric lines of growth which sometimes suggest lamellae, fluted or smooth. The operculum is multispiral, the whorls having a heavy callus deposit on the inner two-thirds, which is somewhat fluted. This also varies in color in the different races from white to red.

Type: *Chondropometes* (*Chondrothyroma*) *sagebienii* (Poey).

This subgenus ranges from Mendoza on the west eastward through the Luis Lazo region along the south side of the Organ Mountains, and the mogotes adjacent to them, to San Diego de los Baños, bending northward to the Sierra la Cumbre, then to the westward to the Sierra San Andrés. The group therefore occupies a distinct range in the Province of Pinar del Rio from that occupied by members of the subgenus *Chondropometes*, except in the Sierra Galalón, Guacamayas, and San Andrés, where two subgenera overlap.

We are recognizing nine species in the subgenus and quite a number of subspecies under these, each of which has its circumscribed zoogeographic distribution.

## KEY TO THE SPECIES OF SUBGENUS CHONDROTHYROMA

Operculum red.

Greater diameter more than 21 mm.----- *eximium*

Greater diameter less than 18 mm.

Axial dark band behind peristome present----- *exquisitum*

Axial dark band behind peristome absent.	
Shell red or reddish.....	sagebieni
Shell not red or reddish.	
Shell white or yellowish.....	concolor
Operculum white.	
Shell red.	
Axial ribs rather distantly spaced.....	magnum
Axial ribs rather closely spaced.....	saccharinum
Shell white or buff.	
Shell banded.....	segregatum
Shell not banded.....	scopulorum

*Chondropometes (Chondrothyroma) bellissimum* has not been considered in this key for want of operculum. It has the size of *C. (C.) exquisitum* but lacks the dark axial band behind the peristome and has much lower and closer spaced axial ribs.

**CHONDROPOMETES (CHONDROTHYROMA) EXIMIUM, new species**

Shell large, resembling *C. (C.) magnum* in shape, but with the axial ribs much finer and closer spaced and the operculum red.

Three races of this species are known. They occupy parts of the Sierra de los Acostas, Sierra San Carlos, and the Sierra del Quemado.

Distribution of the subspecies of *C. (C.) eximium* is shown in figure 73.

**KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) EXIMIUM**

Spiral markings absent.....	eximium
Spiral markings not absent.	
Spiral markings confined to the varicial bands.....	angusticulum
Spiral markings not confined to the varicial bands.....	malleatum

**CHONDROPOMETES (CHONDROTHYROMA) EXIMIUM EXIMIUM, new subspecies**

**PLATE 10, FIGURE 4**

Shell large, pale yellowish, which is also the color of the peristome, the inner being a little paler than the expanded portion, without spiral bands. Axial ribs closely spaced. Spiral threads on the umbilical wall very faint. Operculum red.

The type, U.S.N.M. no. 354925, was collected by Wright at Isabel Maria. It has 4 whorls remaining and measures: Length, 23.2 mm; greater diameter, 22.3 mm; lesser diameter, 15.6 mm.

**CHONDROPOMETES (CHONDROTHYROMA) EXIMIUM ANGUSTICULUM, new subspecies**

**PLATE 10, FIGURE 5**

Shell pale yellow with obsolete spiral bands, which are intensified at irregular intervals, which coincide in axial series. Peristome white; umbilical wall marked by obsolete spiral threads.

The type, U.S.N.M. no. 428801, was collected by Bartsch under a grant from the Walter Rathbone Bacon Traveling Scholarship in

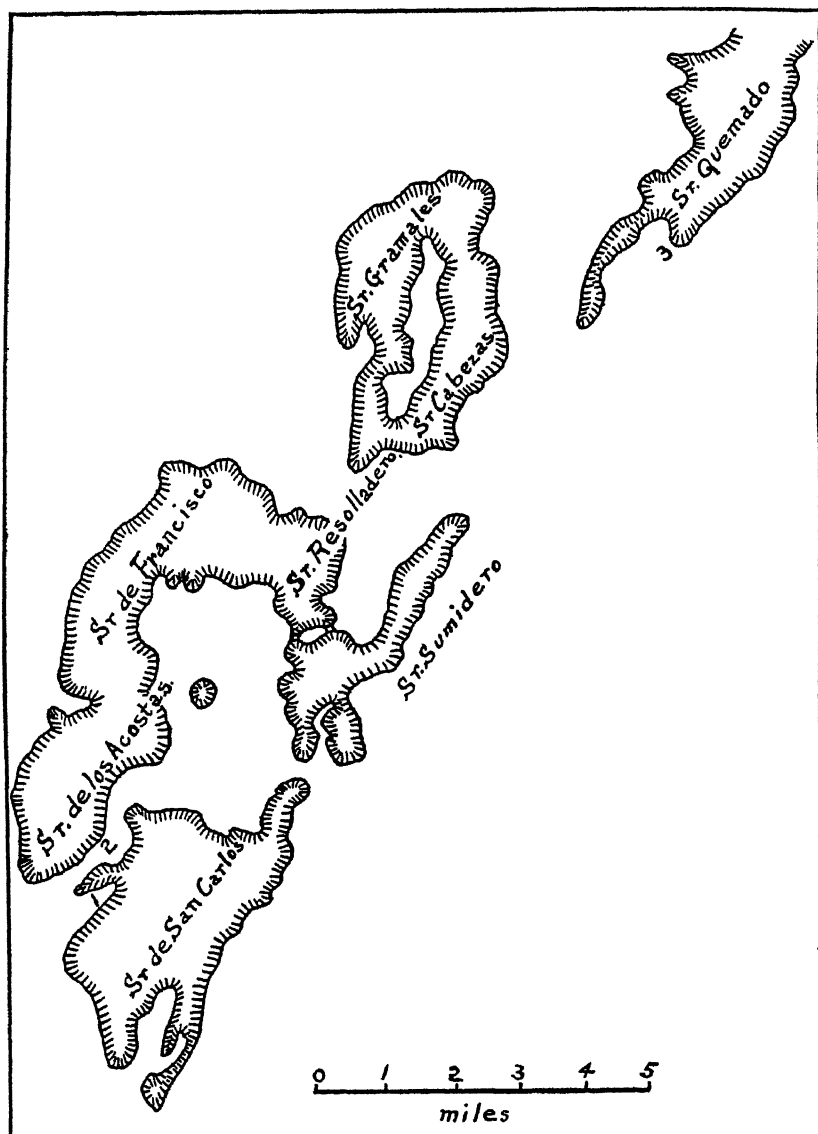


FIGURE 73.—Distribution of the subspecies of *Ohrondropometes* (*Ohrondrothyroma*) *eximium*: (1) *angusticulum*; (2) *malleatum*; (3) *eximium*.

1928, in a small ensenada in the Sierra San Carlos east of the southern extremity of the Sierra de los Acostas. It has 3.8 whorls remaining and measures: Length, 22.3 mm; greater diameter, 22.0 mm; lesser diameter, 14.5 mm.

## CHONDROPOMETES (CHONDROTHYROMA) EXIMIUM MALLEATUM, new subspecies

## PLATE 10, FIGURE 3

Shell large, thin, feebly distantly ribbed, pale yellow, the last whorl malleated, and marked by very conspicuous strong interrupted brown spiral bands. Peristome pale yellow; operculum brilliant red.

The type, U.S.N.M. no. 428802, was collected by Dominguez in the height on the west side of La Estrechura, which is the eastern wall of the southern end of Sierra de los Acostas. It has 4.1 whorls remaining and measures: Length, 24.5 mm; greater diameter, 21.9 mm; lesser diameter, 15.3 mm.

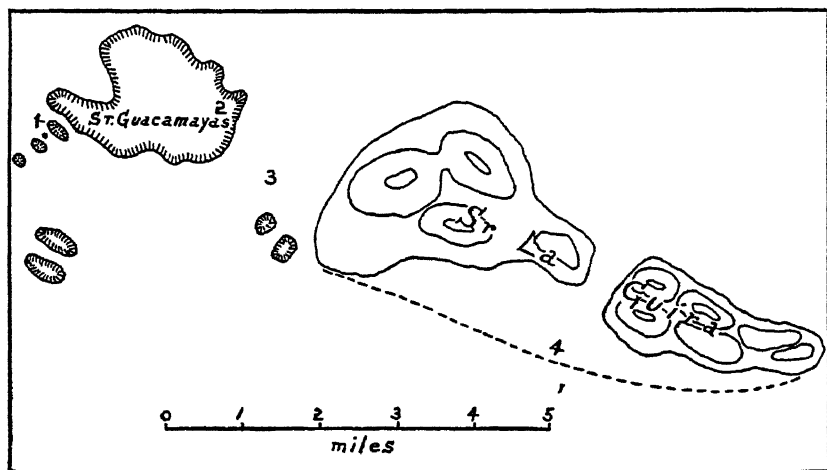


FIGURE 74.—Distribution of the subspecies of *Chondropometes* (*Chondrothyroma*) *exquisitum*: (1) *punctolineatum*; (2) *cereum*; (3) *notatum*; (4) *exquisitum*.

## CHONDROPOMETES (CHONDROTHYROMA) EXQUISITUM, new species

Shell turbinate, of medium size with red operculum, and a darker axial zone immediately behind the peristome. Peristome white or pale yellow. The shell may be white, faintly yellow, wax colored, or dark orange-red; it may be unicolor or spirally banded.

The animal of *C. (C.) exquisitum punctolineatum* has the upper part of the body smoky gray; sides, sole of foot, and snout flesh-color with smoky suffusion. Tentacles sooty black. Sole medially cleft; motion of the two sides alternate. Suspends itself by mucous thread.

This species ranges from the eastern end of the Sierra San Andrés through the Sierra Pico Chico to the Sierra la Guira, and some of the mogotes south of these limestone blocks.

Distribution of the subspecies of *C. (C.) exquisitum* is shown in figure 74.

KEY TO THE SUBSPECIES OF *CHONDROPOMETES* (*CHONDROTHYROMA*) *EXQUISITUM*

Shell banded.

Shell red or reddish.

Spiral bands strongly expressed..... *punctolineatum*

Spiral bands feebly expressed..... *exquisitum*

Shell flesh-color..... *notatum*

Shell not banded..... *cereum*

***CHONDROPOMETES* (*CHONDROTHYROMA*) *EXQUISITUM PUNCTOLINEATUM*, new  
subspecies**

PLATE 11, FIGURE 15

This race was collected by Natenson on Mogote Grande, which lies near the Sierra Guacamayas at its southwestern extremity. The shells from here are a little larger than typical *C. (C.) exquisitum* and are decidedly spirally lined with dark brown. These lines become intensified and broadened in axial series and so lend a varicial aspect to the color scheme.

The type, U.S.N.M. no. 468940, a complete specimen, has 6.0 whorls and measures: Length, 20.3 mm; greater diameter, 18.3 mm; lesser diameter, 12.8 mm.

***CHONDROPOMETES* (*CHONDROTHYROMA*) *EXQUISITUM EXQUISITUM*, new subspecies**

PLATE 11, FIGURE 14

This race ranges through the Sierra la Guira from San Diego de los Banos to the Abra Caiguanabo. Most specimens are bright orange-red, but the color ranges from this to yellow; there is always a dark axial band behind the expanded white peristome. While the shell appears unicolor, it is nevertheless obscurely banded. The spiral markings are usually reduced to mere elongate dots, which are arranged in axial series.

The type, U.S.N.M. no. 468722, is a complete specimen, having 6.1 whorls, and comes from the west end of the Sierra la Guira. It measures: Length, 19.7 mm; greater diameter, 16.0 mm; lesser diameter, 14.1 mm.

***CHONDROPOMETES* (*CHONDROTHYROMA*) *EXQUISITUM NOTATUM*, new subspecies**

PLATE 11, FIGURE 11

Shell white, except for a dark purplish axial band immediately behind the aperture and slender, interrupted, but distinct, spiral bands of brown; peristome white.

The type, U.S.N.M. no. 428803, was collected near the Cueva Oscura del rio Caiguanabo at Los Portales. It is an almost complete speci-

men, having 5.2 whorls remaining, and measures: Length, 19.0 mm; greater diameter, 16.9 mm; lesser diameter, 11.8 mm.

The distribution of this race, so far as known, ranges from Los Portales into the Abra de Caiguanabo, where it meets *C. (C.) exquisitum exquisitum*.

CHONDROPOMETES (CHONDROTHYROMA) EXQUISITUM CEREUM, new subspecies

PLATE 11, FIGURE 13

Shell pale wax yellow, darker on the early whorls, with a moderately broad and not very dark axial band of brown immediately behind the peristome, which is faintly yellowish.

The type, a complete specimen, U.S.N.M. no. 428804, comes from the east end of the Sierra Guacamayas. It has 6.0 whorls and measures: Length, 18.4 mm; greater diameter, 17.2 mm; lesser diameter, 12.0 mm.

CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI (Poey)

This species embraces small shells of bright red or reddish color with red operculum. It occupies the region between Mendoza or Paso Real eastward through the Sierra Guane to mogote Punta de la Sierra. It breaks up into five subspecies, which the following key will help to differentiate.

Distribution of the subspecies of *C. (C.) sagebieni* is shown in figure 75.

KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI

Shell bright red..... *sagebieni*

Shell not bright red, but reddish.

Axial brown zones conspicuous.

Interrupted spiral bands conspicuous..... *portalesense*

Interrupted spiral bands not conspicuous..... *mendozense*

Axial brown zones not conspicuous.

Peristome red..... *parvum*

Peristome white..... *disjunctum*

CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI SAGEBIENI (Poey)

PLATE 11, FIGURE 1

1858. *Cyclostoma sagebieni* POEY, Memorias sobre la historia natural de la Isla de Cuba, vol. 2, p. 33.

This is a little smaller than *C. (C.) sagebieni mendozense* and of bright red color, with an even more flaming peristome. The color extends a little beyond the peristome on the last whorl. No spiral markings have been observed on any of the specimens.



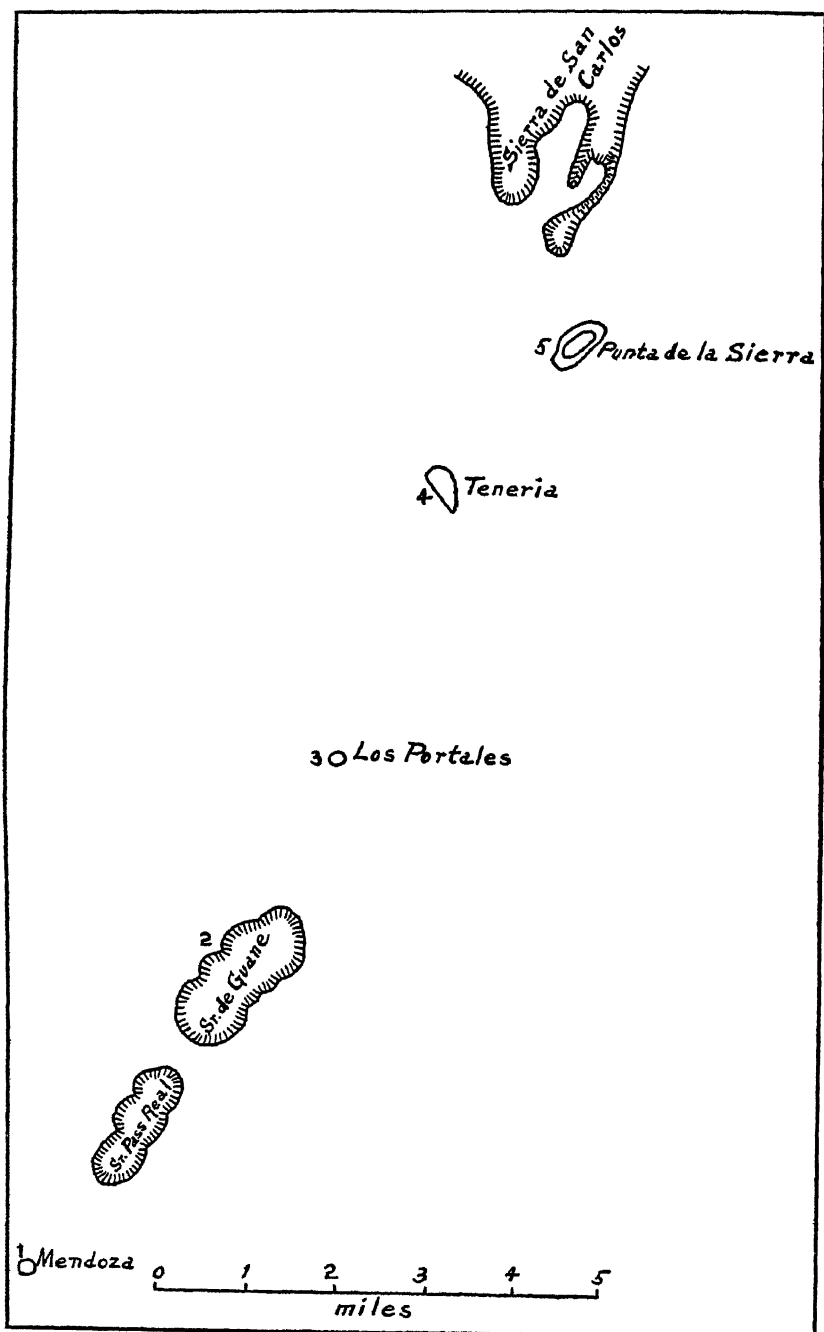


FIGURE 75.—Distribution of the subspecies of *Chondropometes* (*Chondrothyroma*) *sagebieni*: (1) *mendozense*; (2) *sagebieni*; (3) *portalesense*; (4) *parvum*; (5) *disjunctum*

The specimen figured, U.S.N.M. no. 355012, is one of a series from Sierra de Guane. It has 3.5 whorls and measures: Length, 16.2 mm; greater diameter, 13.7 mm; lesser diameter, 11.0 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI PORTALESENSE**, new subspecies

PLATE 11, FIGURE 12

Shell pale red, with the inner peristome and the region immediately behind the peristome on the last whorl a fiery red. The shell is strongly, almost continuously, spirally banded. These spiral markings are accentuated at intervals and produce an axially as well as a spirally banded effect.

The type, U.S.N.M. no. 367737, was collected by Dr. de la Torre at Los Portales. It has 3.5 whorls remaining and measures: Length, 15.7 mm; greater diameter, 13.8 mm; lesser diameter, 9.7 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI MENDOZENSE**, new subspecies

PLATE 11, FIGURE 3

In this subspecies the shell is pale brown, the early whorls darker. The inner half of the peristome is flame red, the outer paler. This bright color also characterizes the rather broad axial band immediately behind the peristome. The whorls are marked by not strongly pronounced interrupted spiral bands of brown.

The type, U.S.N.M. no. 355015, and a series of this species we collected on the Tomas Barrera Expedition in a limestone block immediately adjacent to the station at Mendoza or Paso Real. This has nothing to do with the Sierra de Paso Real but is several miles southwest of this. The type has almost 4 whorls remaining and measures: Length, 18.3 mm; greater diameter, 15.9 mm; lesser diameter, 11.8 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI PARVUM**, new subspecies

PLATE 11, FIGURE 5

Shell very small, pale reddish with the early whorls rather darker in color. Inner peristome pale red; spiral bands present, but very inconspicuous.

The type, U.S.N.M. no. 367747, was collected by Arango at Teneria north of Portales. It has 4 whorls remaining and measures: Length, 13.0 mm; greater diameter, 10.5 mm; lesser diameter, 8.0 mm.

A large series of specimens collected about La Murrallia on both sides of the road agree rather well with the specimens from Teneria.

## CHONDROPOMETES (CHONDROTHYROMA) SAGEBIENI DISJUNCTUM, new subspecies

## PLATE 11, FIGURE 2

The shell of this subspecies is pale red; the peristome white. It is also inconspicuously spirally banded.

The type, U.S.N.M. no. 385118, was collected by Bartsch on the mogote off the tip point of Punta de la Sierra. This has 4 whorls remaining and measures: Length, 16.0 mm; greater diameter, 15.2 mm; lesser diameter, 10.7 mm.

## CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR, new species

Shell small or very small, unicolor, white or yellow, marked by varicial axial streaks due to the fusion of several riblets, or without these. Nuclear whorls about 2, smooth, inflated, well rounded, finely granulose. The early postnuclear whorls distantly ribbed and the later ones more closely so. Peristome white or yellowish; operculum red.

This species is closely related to *C. (C.) scopulorum* but differs from it by the red or reddish operculum. It ranges from the Mogotes de Fonte southeast of the Sierra de San Andrés and Sierra Guacamayas to the Sierra Galalón and some mogotes south of these mountains. It occurs therefore west of *C. (C.) scopulorum*.

We recognize five subspecies in the material before us, which the following key will help to differentiate:

Distribution of the subspecies of *C. (C.) concolor* is shown in figure 76.

## KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR

- Shell pale orange----- concolor
- Shell straw-color.
  - Spiral threads in umbilicus obsolete----- magister
  - Spiral threads in umbilicus not obsolete.
    - Greater diameter less than 12 mm----- fontei
    - Greater diameter more than 13 mm----- spe
  - Shell not straw-color.
  - Shell flesh-color----- carnicolor

## CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR CONCOLOR, new subspecies

## PLATE 11, FIGURE 6

Shell pale orange; peristome white; operculum red. Axial ribs rather distantly spaced; spiral threads in the umbilicus rather feeble.

The type, U.S.N.M. no. 468723, a complete specimen from the low land of the eastern part of the Sierra Guacamayas, has 5.6 whorls and measures: Length, 17.0 mm; greater diameter, 15.7 mm; lesser diameter, 10.8 mm.

## CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR MAGISTER, new subspecies

## PLATE 11, FIGURE 8

Shell very thin, white with a very faint yellowish tinge, marked by varicial white streaks due to the fusion of several of the axial riblets. The axial ribs are rather low and closely spaced. The umbilical wall does not show spiral threads.

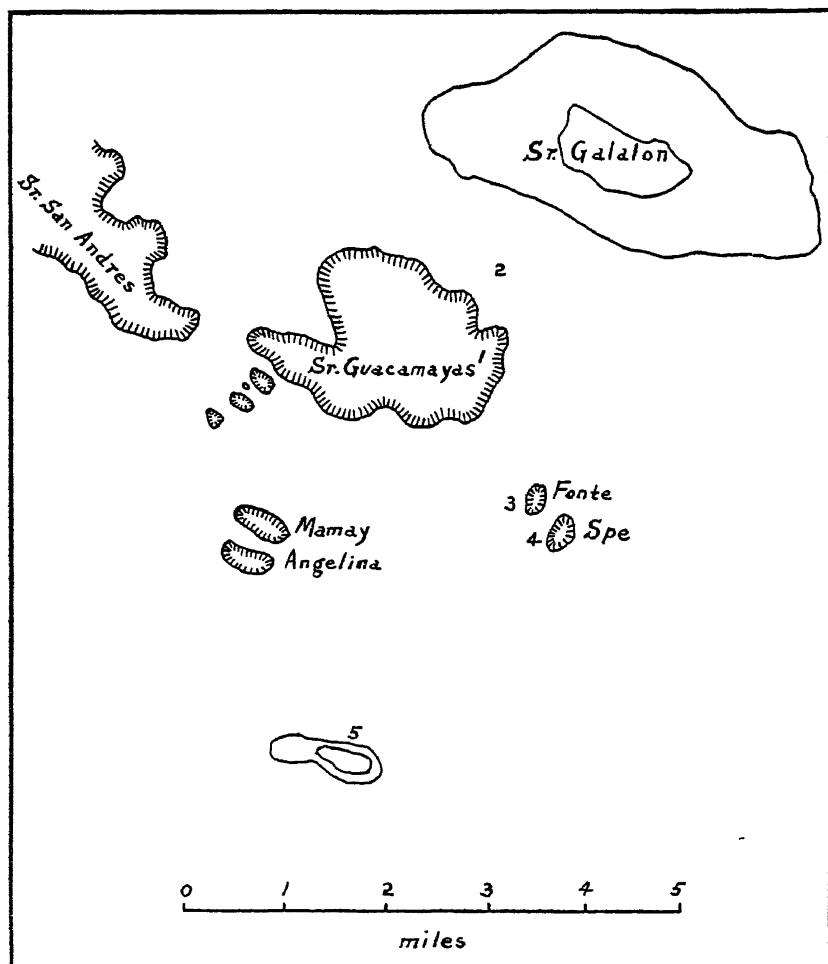


FIGURE 76.—Distribution of the subspecies of *Chondropometes (Chondrothyroma) concolor*: (1) *concolor*; (2) *magister*; (3) *fontei*; (4) *spe*; (5) *carnicolor*.

The type, U.S.N.M. no. 367751, was collected between Galalón and Caiguanabo, without specific locality. It is a complete specimen, having 6.0 whorls, and measures: Length, 16.4 mm; greater diameter, 15.4 mm; lesser diameter, 10.3 mm.

**CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR FONTEI, new subspecies**

## PLATE 11, FIGURE 4

Shell very small, white, with a mere yellowish flush; varicial streaks scarcely indicated. The umbilical wall is marked by feeble spiral threads.

The type, U.S.N.M. no. 428805, comes from the Mogote de Fonte southeast of the Sierra Guacamayas. It is a complete specimen, having 5.3 whorls, and measures: Length, 12.5 mm; greater diameter, 11.0 mm; lesser diameter, 8.0 mm.

This is the smallest race known of this subspecies.

**CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR SPE, new subspecies**

## PLATE 11, FIGURE 9

This subspecies comes from the southern of the two mogotes, southeast of San Andrés, which are collectively known as Mogotes Fonte. The second is embraced by the Finca la Esperanza and may take that name. This subspecies closely resembles that from the sister mogote, Fonte, *C. (C.) concolor fontei*, but is a trifle larger and has the axial ribs more distantly spaced.

The type, U.S.N.M. no. 468724, has 5.5 whorls remaining and measures: Length, 15.2 mm; greater diameter, 12.7 mm; lesser diameter, 8.9 mm.

**CHONDROPOMETES (CHONDROTHYROMA) CONCOLOR CARNICOLOR, new subspecies**

## PLATE 11, FIGURE 7

This race, which is quite similar to *C. (C.) concolor spe* in form and ribbing but is flesh-color, was collected by Natenson on the mogote south of the Casa del Perez Rivera about one and one-half miles south and a little east of the Sierra Guacamayas.

The type, U.S.N.M. no. 468942, has almost 4.0 whorls remaining and measures: Length, 13.7 mm; greater diameter, 11.7 mm; lesser diameter, 8.6 mm.

**CHONDROPOMETES (CHONDROTHYROMA) MAGNUM, new species**

Shell large, turbate, with moderately broad open umbilicus, red or reddish, unicolor or spirally banded. The peristome varies from white to pale reddish. The operculum is white. Nuclear whorls a little more than 2, coiling in perfect harmony with the rest of the spire, inflated, strongly rounded; the first smooth, the next finely microscopically granulose, the last showing fine, closely spaced, microscopic incremental lines. Postnuclear whorls rather abruptly differentiated from the nuclear turn, inflated, strongly rounded, marked by

very slender, retractively slanting lamellar axial ribs between which occasional finer threads appear. This, however, is not a regular arrangement. Suture strongly constricted; periphery well rounded. Base inflated, strongly rounded; the inner wall of the umbilicus is marked by moderately strong, well-rounded, spiral threads, which render the axial ribs somewhat serrulate at their junction. Aperture broadly oval or subcircular. Peristome double, the inner projecting slightly beyond the outer, and slightly expanded, smooth; the outer broadly expanded, marked by concentric lines of growth, not infrequently transversely fluted. Breathing pore a little within the peristome on the parietal wall near the posterior angle. Operculum almost circular, multispiral, the inner four-fifths covered with a rather strong calcareous deposit which gives it a corrugated appearance, the corrugations having a protracted slant.

This large species ranges through the Sierra de los Acostas, the Sierra de San Carlos, the Sierra del Sumidero, the Sierra de Cabezas, and the mogotes lying to the south thereof.

It breaks up into three well-defined zoogeographic races to which we are assigning subspecific rank.

Distribution of the subspecies of *C. (C.) magnum* is shown in figure 77.

#### KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) MAGNUM

Last whorl solute for one-tenth or more of a turn.

Last part of last whorl decidedly deflected..... *elisabethae*

Last part of last whorl not decidedly deflected..... *magnum*

Last whorl almost adnate..... *signae*

#### CHONDROPOMETES (CHONDROTHYROMA) MAGNUM *ELISABETHAE*, new subspecies

#### PLATE 12, FIGURE 12

Shell large, the early postnuclear whorls reddish, the rest buff, marked by rather conspicuous interrupted spiral bands, which are almost as broad as they are long and arranged in axial series. Peristome with a reddish flush on the inner half. The last half of the last whorl is decidedly solute.

The type, U.S.N.M. no. 367749, was collected by Bermudez at Isabel Maria northeast of Sumidero. It has 4.5 whorls remaining and measures: Length, 20.0 mm; greater diameter, 18.0 mm; lesser diameter, 12.5 mm.

#### CHONDROPOMETES (CHONDROTHYROMA) MAGNUM *MAGNUM*, new subspecies

#### PLATE 12, FIGURE 13

In this race the shell is large, ranging in color from pale brown to reddish brown. The peristome may be white or reddish; the outer always with concentric marks and usually with transverse



6.5 whorls. It measures: Length, 24.1 mm; greater diameter, 18.4 mm; lesser diameter, 13.3 mm.

Two specimens of this subspecies have been found by Dr. de la Torre that do not have a breathing pore. One of these is U.S.N.M. no. 469125; the other is in Dr. de la Torre's collection.

**CHONDROPOMETES (CHONDROTHYROMA) MAGNUM SIGNAE, new subspecies**

PLATE 12, FIGURE 14

Shell of medium size, thin, the early whorls reddish, the last one flesh-color, marked by rounded dots, which are arranged in both axial and spiral series. The peristome is white with a yellowish flush. The last whorl is almost adnate, being free only immediately behind the peristome, which is adnate to the preceding turn.

The type, U.S.N.M. no. 385144, and a series of specimens were collected by Bartsch while working under a grant from the Walter Rathbone Bacon Traveling Scholarship in 1928, on the three mogotes east of Cabezas. It has 3.6 whorls remaining and measures: Length, 17.0 mm; greater diameter, 16.2 mm; lesser diameter, 12.5 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SACCHARINUM, new species**

Shell large, varying in color from pale to dark reddish brown, with obsolete darker spiral bands. Axial ribs rather low and moderately closely spaced. Peristome white or pale brown. Operculum white.

This species, which is now known only from Pan de Azucar and the Cueva del Martillo, in the Sierra Martillo range that connects the Sierra Chichones with the Sierra Celadas and del Infierno, resembles *C. (C.) magnum* in size and color of operculum, while in strength of axial ribs and their spacing and in a lack of spiral lirations it approaches *C. (C.) eximium*, differing markedly from this, however, in the color of the operculum.

Distribution of the subspecies of *C. (C.) saccharinum* is shown in figure 78.

KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA)  
SACCHARINUM

Shell dark red.....	rubicollum
Shell pale red.....	saccharinum

**CHONDROPOMETES (CHONDROTHYROMA) SACCHARINUM RUBICOLLUM, new subspecies**

PLATE 13, FIGURE 1

Shell dark reddish brown, with obsolete darker spiral bands and a brilliant red axial zone immediately behind the peristome; expanded peristome pale brown with a reddish suffusion.



The type, U.S.N.M. no. 468847, has 4.3 whorls remaining and measures: Length, 21.7 mm; greater diameter, 18.8 mm; lesser diameter, 14.2 mm. It comes from the Sierra Martillo.

The brilliant red axial zone behind the peristome and darker coloration will readily distinguish this from *C. (C.) saccharinum saccharinum*.

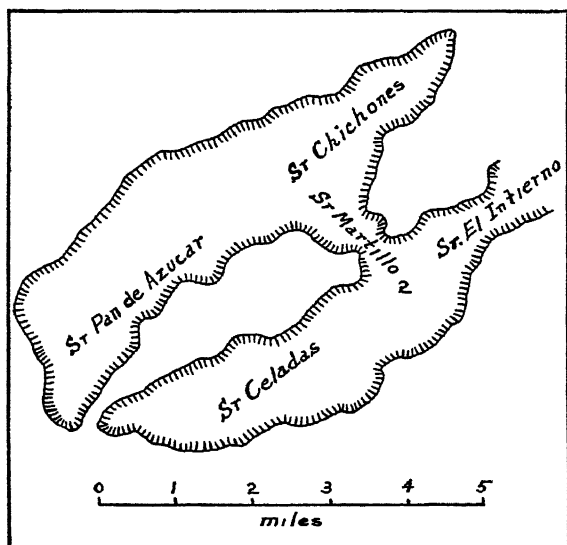


FIGURE 78.—Distribution of the subspecies of *Chondropometes* (*Chondrothyroma*) *saccharinum*: (1) *saccharinum*; (2) *rubicollum*.

**CHONDROPOMETES (CHONDROTHYROMA) SACCHARINUM SACCHARINUM, new subspecies**

PLATE 13, FIGURE 3

This race, which comes from Pan de Azucar, is readily distinguished from *C. (C.) saccharinum rubicollum* by its paler color and white peristome and by the absence of the brilliant-red axial zone behind the peristome.

The type, U.S.N.M. no. 355024, which was collected on the Tomas Barrera Expedition, has 4 whorls remaining and measures: Length, 19.2 mm; greater diameter, 17.0 mm; lesser diameter, 12.7 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM, new species**

Shell of small or medium size, white, straw-color, pale buff, or sometimes faintly reddish, usually marked by interrupted spiral bands, which vary much in size and intensity of color and are present on both spire and base. Peristome pale yellowish or white.

Nuclear whorls about 1.5, inflated, strongly rounded, continuing the outline of the postnuclear spire in their coiling. Postnuclear whorls strongly inflated and separated by a strongly impressed suture and marked on the early whorls by very strong lamellar, retractively slanting, axial riblets, which become a little more closely spaced on the last turn. Umbilical wall marked by rather distantly spaced spiral threads which here render the axial riblets somewhat serrulate. Peristome double, the outer broadly expanded, marked by concentric lamellae. Operculum white, multispiral, the inner four-fifths of the whorls covered with a heavy callus, which is laid down in a somewhat fluted manner, the thickenings curved retractively.

The animal of *C. (C.) segregatum* is flesh-color with a smoky suffusion, the tip of the snout a little paler than the rest. Tentacles smoky gray, a little paler at the tip. Sole of foot flesh-color with pale smoky suffusion. The sole of the foot is medially longitudinally cleft, the locomotory waves being alternate.

The subspecies of this species are widely scattered among mogotes lying east and south of the Organ Mountains and about or west of the road that leads from Pinar del Rio to Vinales. The exception to this is *C. (C.) segregatum sporadicum* from Mogote Quilla, Finca el Descanso, Entronque de Herradura, which, in spite of its distance from *C. (C.) segregatum segregatum* from the mogotes at Kilometer 14, is quite similar to this.

This species is distinguished from the other small forms by its strongly banded colored pattern and by the exceedingly strongly developed lamellar ribs, which give the shell a rough surface.

Distribution of the subspecies of *C. (C.) segregatum* is shown in figure 79.

KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA)  
SEGREGATUM

Greater diameter more than 16 mm.

Spiral bands strong..... felipense

Spiral bands not strong.

Spiral bands feeble.

Greater diameter more than 19 mm..... lagunitasense

Greater diameter less than 17 mm..... arangoi

Spiral bands absent..... vallei

Greater diameter less than 15 mm.

Spiral markings strong..... laureani

Spiral markings not strong, sometimes absent.

Umbilicus rather broad..... segregatum

Umbilicus rather narrow.

Shell yellow..... sporadicum

Shell white..... mameyi

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM FELIPENSE, new subspecies**

PLATE 12, FIGURE 2

This is a medium-sized thin-shelled race. It is of pale buff ground color, with the peristome much paler. The whorls and base are conspicuously marked with almost continuous dark brown spiral bands.

Our shells come from a small mogote  $\frac{1}{2}$  kilometer west of Kilometer 14.

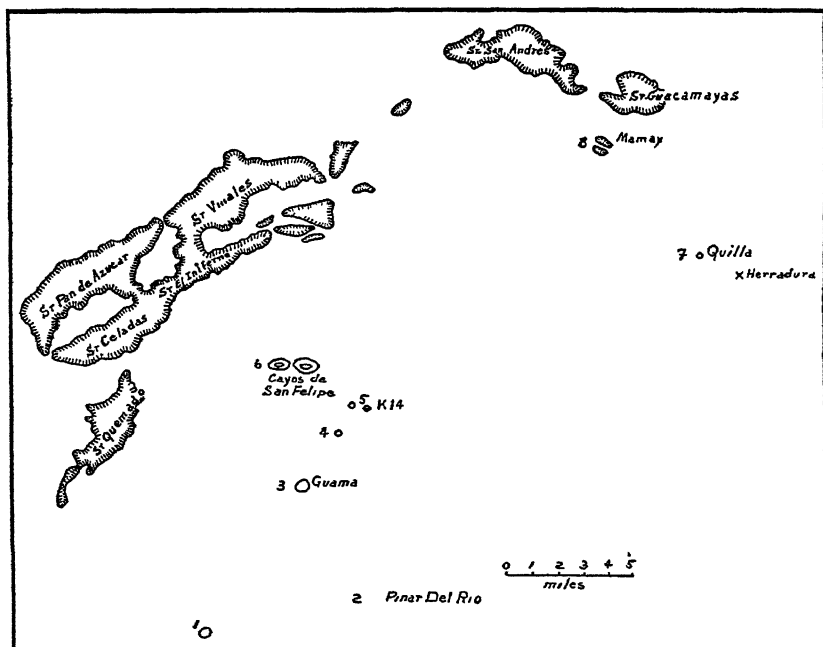


FIGURE 79.—Distribution of the subspecies of *Chondropometes* (*Chondrothyroma*) *segregatum*: (1) *lagunitasense*; (2) *laureani*; (3) *arangoi*; (4) *vallei*; (5) *segregatum*; (6) *felipense*; (7) *sporadicum*; (8) *mameyi*.

The type, U.S.N.M. no. 468725, an almost complete specimen, has 5.2 whorls remaining and measures: Length, 19.7 mm; greater diameter, 17.3 mm; lesser diameter, 12.6 mm.

The strong spiral color bands distinguish this from the other larger subspecies. Bartsch collected a dead specimen on Cayo San Felipe, which seems indistinguishable from this race.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM LAGUNITASENSE, new subspecies**

PLATE 12, FIGURE 3

Shell buff with broad, decidedly interrupted spiral zones of brown. Some of these marks are wider than the spaces that separate them. Peristome pale buff.

The type, U.S.N.M. no. 367739, was collected by Arango at Los Lagunitas. It has 3.8 whorls remaining and measures: Length, 19.7 mm; greater diameter, 19.7 mm; lesser diameter, 13.7 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM ARANGOI, new subspecies**

PLATE 12, FIGURE 9

Shell pale buff, the early turns with a reddish tinge, marked with inconspicuous, rather narrow, interrupted spiral bands of brown. These spiral markings are also arranged in axial series. Peristome white.

The type, U.S.N.M. no. 367746, a complete specimen, was collected by Arango at Hoyo Guama. It has 6.4 whorls and measures: Length, 20.3 mm; greater diameter, 16.2 mm; lesser diameter, 10.7 mm.

The more conic outline and pale color distinguish this readily from the others of the larger races.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM VALLEI, new subspecies**

PLATE 12, FIGURE 1

Shell white, unicolor, with the peristome white. Umbilicus with conspicuous spiral threads.

The type, U.S.N.M. no. 428800, was collected by Bartsch and Valle in 1928 on the tall mogote about one and one-half miles southwest of Kilometer 14 between Pinar del Rio and Vinales. It has 4.1 whorls remaining and measures: Length, 19.8; greater diameter, 19.0 mm; lesser diameter, 13.4 mm.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM LAUREANI, new subspecies**

PLATE 12, FIGURE 6

Shell small, buff, with white peristome. The conspicuous interrupted brown bands have the elements composing them also arranged in axial series. These are so broad that their arrangement almost produces axial bands; in fact they appear more as axial bands than spiral ones.

This race comes from Mogote de la Caja west of Pinar del Rio.

The type, U.S.N.M. no. 468726, has 3.5 whorls remaining and measures: Length, 14.9 mm; greater diameter, 12.7 mm; lesser diameter, 9.0 mm.

The strong spiral and axial arrangements of the color bands readily distinguish this from the other small races of *C. (C.) segregatum*.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM SEGREGATUM, new subspecies**

## PLATE 12, FIGURE 4

Shell small, rather broadly umbilicated, straw-color, marked by faint interrupted spiral bands of brown; peristome pale yellowish.

The type, U.S.N.M. no. 355037, was collected on the Tomas Barrera Expedition on the mogote on the east side of Kilometer 14, between Pinar del Rio and Vinales. It is a complete specimen having 6 whorls and measures: Length, 15.6 mm; greater diameter, 12.7 mm; lesser diameter 9.6 mm.

This subspecies we also collected on the whole complex of mogotes nestling about Kilometer 14, but although we kept the shells collected on the various rock piles distinct, careful examination does not reveal any distinguishing characters. We are therefore applying this name to the entire lot. This subspecies resembles *C. (C.) segregatum sporadicum* mostly but has a heavier shell and wider umbilicus.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM SPORADICUM, new subspecies**

## PLATE 12, FIGURE 5

Shell small, very thin, of pale buff ground color with the peristome a little paler in color, or feebly marked with rather distantly spaced, interrupted spiral bands of brown.

The type, U.S.N.M. no. 468727, comes from Mogote de Quilla, Finca el Descanso, Entronque de Herradura. It is a complete specimen having 5 whorls and measures: Length, 14.0 mm; greater diameter, 12.0 mm; lesser diameter, 6.3 mm.

The thinner shell and narrower umbilicus distinguish this from *C. (C.) segregatum segregatum*.

**CHONDROPOMETES (CHONDROTHYROMA) SEGREGATUM MAMEYI, new subspecies**

## PLATE 12, FIGURE 8

Shell similar to *C. (C.) segregatum sporadicum* but white with a mere flush of yellow. As in that race, the shell may or may not have pale brown interrupted spiral lines arranged in axial series on spire and base. The axial ribbing in this is also a little stronger, which is also true of the obsolete spiral sculpture.

This subspecies was collected by Natenson on Mogote Mamey, the northern one of the two large limestone peaks off the southwestern end of the Sierra Guacamayas.

The type, U.S.N.M. no. 468928, a complete specimen, has 6.0 whorls and measures: Length, 15.4 mm; greater diameter, 12.7 mm; lesser diameter, 8.9 mm.

## CHONDROPOMETES (CHONDROTHYROMA) SCOPULORUM, new species

Shell small, unicolor, white or yellowish white. Operculum white or pale reddish. Nuclear whorls about 2, very finely granulose, strongly inflated and rounded, continuing the outline of the rest of the spire. Postnuclear whorls inflated, strongly rounded, separated by a well-impressed suture, and marked by retractorily curved lamellar axial riblets, which are a little more definitely spaced on the early whorls than the later. Umbilicus varying in width in the different races, but always broadly open. Umbilical wall with or without spiral threads. Peristome double; the outer broadly expanded and reflected, the inner only slightly expanded and reflected. Operculum multispiral with a rather thick callus on the inner four-fifths, which is somewhat fluted, the thickening having a retractive slant.

The animal of *C. (C.) scopulorum perplexum* was described by Bartsch in the field from specimens collected at Cueva del Indio, Mogote Colorado, near San Diego Banos, Pinar del Rio Province, June 17, 1928, as follows: Animal pale smoky gray; tentacles almost sooty with a subterminal paler band. Snout a little paler than the general coloration of the body: edge of body at foot flesh-color. Sole of foot flesh-color with a faint smoky flush. The internal anatomy shines through the body wall behind the tentacles with a rosy flush. The short foot is longitudinally medially, deeply cleft, in progression; the motion of the two sides is alternate.

This species ranges from the Sierra de Guira, eastward to the Sierra la Cumbre. The Rio San Diego divides the mountains to the east from the mountains to the west. Those to the west of San Diego los Banos harbor *C. (C.) scopulorum scopulorum*, while the mogotes to the east of the Rio San Diego harbor *C. (C.) scopulorum perplexum*. The Sierra la Cumbre itself harbors *C. (C.) scopulorum cumbrense*.

Distribution of the subspecies of *C. (C.) scopulorum* is shown in figure 80.

## KEY TO THE SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) SCOPULORUM

Spiral threads in umbilicus fairly strong-----	cumbrense
Spiral threads in umbilicus obsolete.	
Axial ribs closely spaced-----	scopulorum
Axial ribs distantly spaced-----	perplexum

## CHONDROPOMETES (CHONDROTHYROMA) SCOPULORUM CUMBRENSE, new subspecies

## PLATE 12, FIGURE 10

Shell small, yellowish white with the ribs rather distantly spaced and the spiral threads on the umbilicus rather prominent. There

are also approximations of some of the riblets at irregular intervals, which give the shell a somewhat varicid aspect.

The type, U.S.N.M. no. 367742, was collected by Mr. Henderson on the south side of the west end of Sierra la Cumbre. It is a complete specimen, having 6 whorls, and measures: Length, 18.0 mm; greater diameter, 15.2 mm; lesser diameter, 10.4 mm.

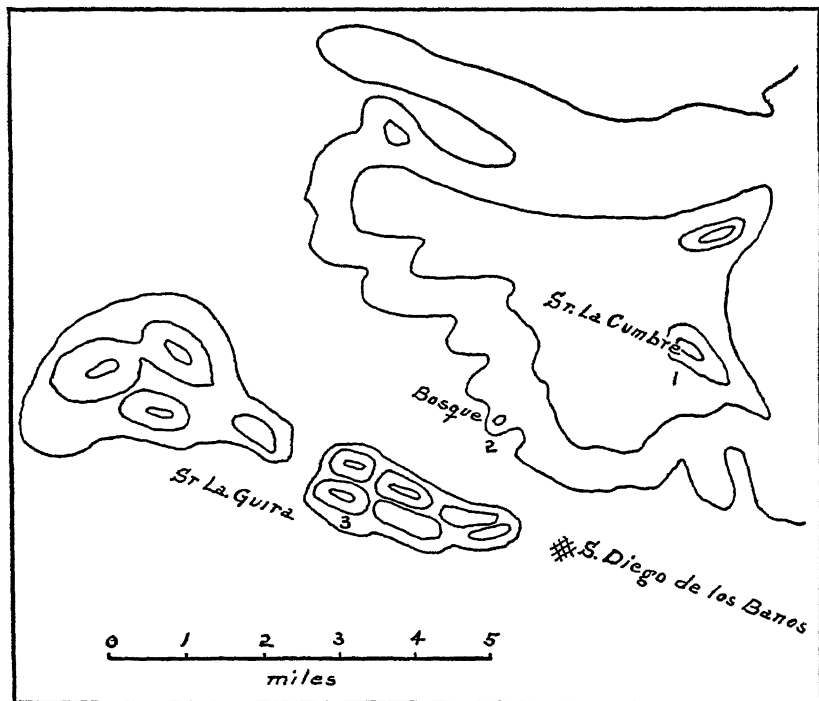


FIGURE 80.—Distribution of the subspecies of *Chondropometes* (*Chondrothyroma*) *scopulorum*: (1) *cumbrense*; (2) *perplexum*; (3) *scopulorum*.

**CHONDROPOMETES (CHONDROTHYROMA) SCOPULORUM SCOPULORUM, new subspecies**

PLATE 12, FIGURE 11

Shell of medium size, marked by rather closely spaced, decidedly sublamellar axial ribs. Umbilical wall without spiral threads. There is also no delimiting cord at the outer edge of the umbilicus.

The type, U.S.N.M. no. 335034, was collected by Mr. Henderson on the third mogote west of the river and north of San Diego de los Baños. It has 3.5 whorls remaining and measures: Length, 16.6 mm; greater diameter, 15.8 mm; lesser diameter, 11.8 mm.

We have this race from a number of mogotes from the southeastern part of the Sierra la Guira.

## CHONDROPOMETES (CHONDROTHYROMA) SCOPULORUM PERPLEXUM, new subspecies

## PLATE 12, FIGURE 7

Shell small, white, with the ribs sublamellar, rather closely spaced. Spiral threads in the umbilicus feeble; peristome broadly expanded.

The type, U.S.N.M. no. 367748, was collected by Aguayo and Bermudez on Mogote Colorado near San Diego de los Baños, on the east side of the Rio San Diego. It has 4.1 whorls remaining and measures: Length, 17.9 mm; greater diameter, 16.0 mm; lesser diameter, 11.5 mm.

Specimens of this subspecies have been found without breathing pore. We have also specimens from Mogote Bosque.

## CHONDROPOMETES (CHONDROTHYROMA) BELLISIMUM, new species

## PLATE 11, FIGURE 10

Shell rather large, bright red except for the broadly reflected peristome, which is yellowish white. Operculum red. The axial ribs are rather low and closely spaced, the spaces between them on the last whorl being almost as narrow as the ribs. The last half of the last whorl also shows poorly developed spiral threads, which are best developed on the base. The umbilical wall is also marked by conspicuous spiral threads. This species recalls *C. (C.) eximium eximium* but can at once be distinguished from that by the absence of the dark axial band immediately behind the peristome, by the much lower and more closely spaced axial ribs, and by its having the spiral striations on the last whorl referred to above.

The type, U.S.N.M. no. 367743, was collected by Arango at Mogote del Bosque de Galalón. It has 4.5 whorls remaining and measures: Length, 19.3 mm; greater diameter, 17.8 mm; lesser diameter, 11.9 mm.

## HENDERSONINA, new genus

Brilliantly colored shells, varying in shape from broadly to narrowly ovate to elongate-turreted. The early nuclear whorls are smooth, the first portion of the first postnuclear whorl showing axial threads that soon develop into axial riblets on the succeeding portions of the shell. Beginning with the last part of the first postnuclear whorl, spiral threads make their appearance, which render the axial riblets nodulose at their junction on the early postnuclear whorl. The axial and spiral sculpture may both become enfeebled beyond the first half of the spire, as in *Hendersonina* (*Hendersonina*) *hendersoni*, or persist quite strongly to the end, as in some of the races of *H. (Hendersonida) discolorans* and *H. (Scobinapoma) scobina*. The suture may or may not be crenulated.



Base umbilicated. Aperture large, almost subquadratic, forming an angle at the junction of the outer lip and parietal wall. Peristome double, the inner only slightly expanded and appressed to the outer, which is expanded in varying degrees in the different species. Breathing pore present in *Hendersonina*; absent in the other two subgenera. Operculum multispiral with excentric nucleus, the inner four-fifths of the turns covered with a heavy granular deposit which is more or less fluted.

Type: *Hendersonina* (*Hendersonina*) *hendersoni* (Torre).

#### KEY TO THE SUBGENERA OF GENUS HENDERSONINA

Shell elongate-turreted; breathing pore present-----	<b>Hendersonina</b>
Shell ovate; breathing pore absent.	
Outer lip broadly expanded-----	<b>Hendersonida</b>
Outer lip not broadly expanded-----	<b>Scobinapoma</b>

#### HENDERSONINA, new subgenus

Shell elongate-turreted, brilliantly varicolored, breathing pore present on the parietal wall near the posterior angle of the aperture.

Type: *Hendersonina* (*Hendersonina*) *hendersoni* (Torre).

#### HENDERSONINA (HENDERSONINA) HENDERSONI (Torre)

#### PLATE 13, FIGURE 13

1909. *Chondropoma hendersoni* TORRE, Nautilus, vol. 23, pp. 49-50, pl. 4, fig. 6.

1920. *Chondrothyra* (*Chondrothyra*) *hendersoni* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

The elongate-turreted shape and variegated color combined with a breathing pore render this not only a most beautiful but most distinct species found in all Cuba. It is confined to the northeastern end of the Costanera del Abra, occupying the high parts of an extremely limited area.

The type, U.S.N.M. no. 492714, has 5.5 whorls remaining (it has probably lost 4.5 whorls at the tip) and measures: Length, 26.8 mm; greater diameter, 15.4 mm; lesser diameter, 10.6 mm. The other specimen that we figure has lost the first 2 whorls; the 8 remaining measure: Length, 31.6 mm; greater diameter, 15.7 mm; lesser diameter, 11.6 mm.

The animal is very short, ashy gray, and has long, slender, coral-red tentacles. The foot is longitudinally medially divided. Locomotion of the two sides alternate.

#### HENDERSONIDA, new subgenus

Medium-sized shells of broadly ovate outline, usually brilliantly colored; suture crenulated with a series of tufts, the rest of the whorls

nodulose at the junction of the axial riblets and spiral threads. All sculpture decidedly reduced on the last whorl. Aperture broadly ovate; peristome double, the outer broadly expanded, less so on the parietal wall, somewhat fluted, marked by feeble concentric threads; the inner narrowly expanded, reflected over and adnate to the outer. Operculum thin, corneus, covered, with a fine granular deposit.

Type: *Hendersonina* (*Hendersonida*) *discolorans* (Wright) Pfeiffer.

**HENDERSONINA (HENDERSONIDA) DISCOLORANS (Wright) Pfeiffer**

Shell of medium size, broadly ovate, yellow or of various shades of rose color, sometimes spirally banded; peristome white; operculum horn-color or with rosy flush. Nuclear whorls a little more than 2, well rounded, very minutely granulose, the last portion of the last turn with a few feeble axial threads. Postnuclear whorls inflated, well rounded, marked by weak axial and spiral threads, which on the early whorls form slightly cusplike tubercles at their junction. Suture deeply impressed, marked by irregularly developed and distributed tufts on the summits of the whorls. Periphery and base of the last whorl inflated, strongly rounded, the latter openly umbilicated and marked by feeble axial and spiral threads. The last whorl may or may not be solute for a fraction of a turn.

The known range of this species extends through the Laguna Piedras northward to the Sierra San Andrés and east to Mogote Fonte.

We are recognizing three subspecies, which the adjoining key will help to identify:

Distribution of the subspecies of *H. (H.) discolorans* is shown in figure 81.

**KEY TO THE SUBSPECIES OF HENDERSONINA (HENDERSONIDA) DISCOLORANS**

Shell rose-color.

Base not darker than the rest of the last whorl..... *discolorans*

Base darker than the rest of the last whorl..... *bicolor*

Shell yellow..... *decolor*

**HENDERSONINA (HENDERSONIDA) DISCOLORANS DISCOLORANS (Wright) Pfeiffer**

**PLATE 13, FIGURE 9**

1863. *Chondropoma discolorans* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 10, p. 189.

This subspecies, whose base is colored like the rest of the last whorl, comes from the mogotes scattered through the Laguna Piedras from Puertecitas north to Mogote La Jagua de San Antonio. While it shows considerable diversity through this range, the variables are

not fixed for isolated mogotes but appear to be present in each of them, that is, definite subspecific characters associated with definite mogotes are not present.

The specimen figured, U.S.N.M. no. 367761, comes from Mogote Capon. It has lost most of the nuclear turns; the 5 whorls remaining measure: Length, 20.3 mm; greater diameter, 13.4 mm; lesser diameter, 10.0 mm.

**HENDERSONINA (HENDERSONIDA) DISCOLORANS BICOLOR, new subspecies**

PLATE 13, FIGURE 10

Shell averaging smaller than *H. (H.) discolorans discolorans* and having the last whorl much oftener adnate than that subspecies. The base in this is also always darker than the rest of the last whorl.

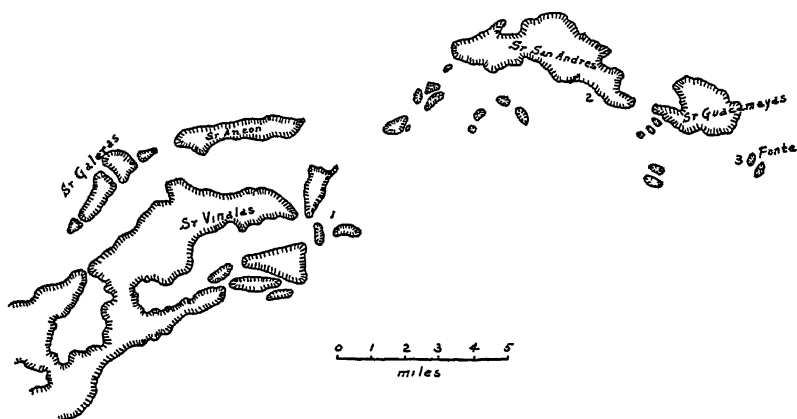


FIGURE 81.—Distribution of the subspecies of *Hendersonina (Hendersonida) discolorans*: (1) *discolorans*; (2) *bicolor*; (3) *decolor*.

The type, U.S.N.M. no. 492715, comes from the south side of the Sierra San Andrés. It has 5 whorls remaining and measures: Length, 17.0 mm; greater diameter, 11.8 mm; lesser diameter, 8.3 mm.

This subspecies we know from the south side of the Sierra San Andrés and some of the mogotes to the south and southeast of this

**HENDERSONINA (HENDERSONIDA) DISCOLORANS DECOLOR, new subspecies**

PLATE 13, FIGURE 8

A large series of specimens from the Mogote de Fonte, southeast of the Sierra Guacamayas look as if they were partial albinos; they are uniformly pale yellow with white peristome. They are also smaller than the other two races. The extreme tip has a dark spot.

The type, U.S.N.M. no. 492716, the only complete specimen that we have seen in all the material examined of all the races, has 6.0 whorls and measures: Length, 16.3 mm; greater diameter, 11.2 mm; lesser diameter, 8.2 mm.

SCOBINAPOMA, new subgenus

Very small *Hendersonina* of ovate shape with filelike sculpture on the postnuclear whorls. Aperture very broadly ovate; peristome double; outer and inner almost equal in expansion and reflection, which is slight.

Type: *Hendersonina* (*Scobinapoma*) *scobina* (Gundlach) Pfeiffer.

Three species are known in this subgenus, which the following key will help to differentiate:

Distribution of the species and subspecies of *Scobinapoma* is shown in figure 82.

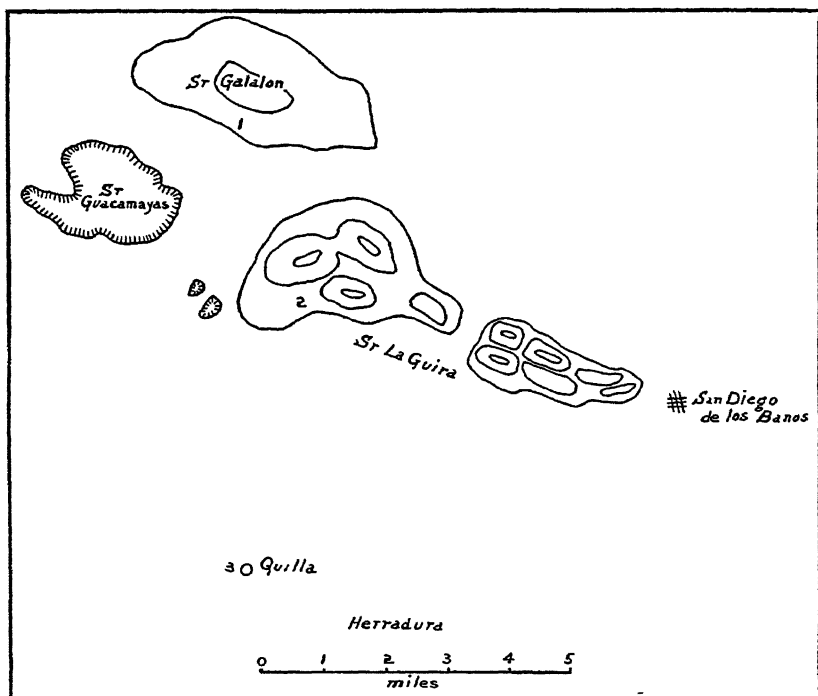


FIGURE 82.—Distribution of the species and subspecies of subgenus *Scobinapoma*: (1) *H. (S.) scobina galalonensis*; (2) *scobina scobina* and *cirrata*; (3) *maculata*.

KEY TO THE SPECIES OF SUBGENUS SCOBINAPOMA

Outer lip of same color as rest of shell..... *scobina*

Outer lip not same color as rest of shell.

Outer lip spotted.

Last whorl interruptedly banded..... *maculata*

Last whorl not interruptedly banded..... *cirrata*

## HENDERSONINA (SCOBINAPOMA) SCOBINA (Gundlach) Pfeiffer

Shell quite small, ovate, red or pale yellow, usually with a thin periostracum, which gives the surface a watered-silk effect. Nuclear whorls about 2, microscopically granulose, the last portion showing a few hairlike incremental lines. Postnuclear whorls with fine tubercles which lend the surface a filelike aspect. The last whorl is always solute and somewhat descending near the end. Base well rounded, narrowly openly umbilicated. Aperture broadly oval, almost sub-circular, angulated posteriorly. The peristome is double, the outer narrowly expanded and reflected, the inner only slightly smaller, also reflected and adnate to the outer. Operculum thin, covered with a finely granular deposit.

Of the animal of *H. (S.) scobina*, Gundlach says that it is brownish with small flecks of white on all of the foot. Head, with the exception of the snout, blackish. Eye ring and base of tentacles clay-yellowish-white, tentacles black with yellowish tip. The animal spins a rather long thread with which it suspends itself.

The animals of *H. (S.) scobina galanonensis* seen by us have the sides of the body and tip of the snout smoke-gray, the rest of the snout and median dorsal parts are sooty. Sole of foot smoke-gray. The base of the tentacles is smoke-gray, the middle half sooty, the distal fourth orange.

## KEY TO THE SUBSPECIES OF HENDERSONINA (SCOBINAPOMA) SCOBINA

Shell more than 11 mm in length..... *galanonensis*  
 Shell less than 10 mm in length..... *scobina*

## HENDERSONINA (SCOBINAPOMA) SCOBINA SCOBINA (Gundlach) Pfeiffer

## PLATE 13, FIGURE 12

1863. *Chondropoma scobina* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol 10, pp. 189-190.

Shell bright red or yellow, the thin periostracum lending it a watered-silk effect. Peristomes narrow, a little more so on the parietal wall than the rest, inner about one-half as expanded as the outer.

The specimen figured, U.S.N.M. no. 354929, was received from Gundlach. It comes from the type locality, Sierra la Guira, and has 4.6 whorls remaining and measures: Length, 9.8 mm; greater diameter, 6.7 mm; lesser diameter, 5.4 mm.

This subspecies is very similar to *H. (S.) scobina galanonensis*, from which its much smaller size will at once distinguish it.

## HENDERSONINA (SCOBINAPOMA) SCOBINA GALALONENSIS, new subspecies

## PLATE 13, FIGURE 14

Shell similar to *H. (S.) scobina scobina* but much larger; only red forms have so far been seen. This race comes from the Sierra de Galalon.

The type, U.S.N.M. no. 367762, was collected by Arango. It has 4.7 whorls remaining and measures: Length, 11.3 mm; greater diameter, 7.6 mm; lesser diameter, 6.3 mm.

## HENDERSONINA (SCOBINAPOMA) CIRRATA (Wright) Pfeiffer

## PLATE 13, FIGURE 4

1867. *Cyclostoma (Chondropoma) cirratum* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 14, pp. 210-211.

Shell quite small, ovate, flesh-colored with the plugged part of the first of the remaining whorls blackish brown and with the outer lip interruptedly purplish chocolate-brown. Peristome very narrow, a little wider on the outer lip than on the columellar and parietal walls.

The specimen figured, U.S.N.M. no. 25095, was received from Wright and is a topotype from the Sierra la Guira. It has 4 whorls remaining and measures: Length, 8.3 mm; greater diameter, 5.8 mm; lesser diameter, 4.1 mm.

## HENDERSONINA (SCOBINAPOMA) MACULATA, new species

## PLATE 13, FIGURE 11

Shell small, flesh-color, with a greenish tinge, marked by 3 broad, interrupted spiral bands of chestnut-brown between the summit and the periphery of the last whorl and two additional ones of the same strength and coloration on the base. The cusping is less strong and less numerous than in the other two species, that is, there are fewer spiral threads and axial riblets.

The type, U.S.N.M. no. 492717, a complete specimen, has 6 whorls and measures: Length, 9.4 mm; greater diameter, 5.7 mm; lesser diameter, 4.5 mm. It comes from Mogote de Quilla (Canas Alta) southwest of Entronque de Herradura.

In this species the body of the animal is smoky gray tending toward sooty on the posterior half of the snout and the median line between the tentacles. The sides are a little darker than the rest of the upper surface. The sides are marked with innumerable fine white dots. Tentacles gently tapering until the distal third, from there on swollen, yellowish on the basal half, smoke-gray on the rest, but with the sides of the swollen distal third sooty. The internal anatomy

shines through the integument of the animal as a rosy flush behind the tentacles. Sole of foot smoke-gray, medially longitudinally cleft; locomotion of the two sides alternate.

The animal at rest usually suspends itself by a mucous thread.

#### TURRITHYRA, new genus

Shell large, elongate-turreted, unicolor, axially or spirally banded, or both, with axial and spiral riblets and threads whose junction may or may not form tubercles or short spines. Sutures minutely tufted. Aperture large, broadly oval or subcircular; peristome double, expanded to a varying degree in the different species. A breathing pore may or may not be present.

Type: *Turrithyra* (*Turrithyra*) *canaliculata* (Gundlach) Pfeiffer.

This genus is readily divisible into three subgenera, as indicated by the following key:

#### KEY TO THE SUBGENERA OF TURRITHYRA

Breathing pore present.

Inner lip cut, posterior half reflected over umbilicus----- *Turrithyretes*

Inner lip not cut, posterior half not reflected over umbilicus---- *Turrithyra*

Breathing pore absent----- *Turripoma*

#### TURRITHYRETES, new subgenus

Those *Turrithyras* that possess a breathing pore and have the inner lip cut with the posterior half reflected over the umbilicus.

Type: *Turrithyra* (*Turrithyretes*) *sinuosa* (Wright) Pfeiffer.

#### KEY TO THE SPECIES OF SUBGENUS TURRITHYRETES

Shell strongly echinulate----- *echinulata*

Shell not strongly echinulate----- *sinuosa*

#### TURRITHYRA (TURRITHYRETES) ECHINULATA (Wright) Pfeiffer

Shell red or reddish, unicolor or spirally banded, with the peristome white or pale yellow. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, well rounded, marked by slender, retractively slanting axial and spiral threads, the junction of which forms strong spines or cusps whose tips are retractively curved. These cusps continue undiminished over the last whorl and its base. Peristome double, the outer broadly expanded and reflected, radially fluted and marked with incremental lines. That of the posterior half of the inner lip is reflected over and covers the umbilicus. The inner peristome is less extensive, it is also reflected and adnate to the outer.

The exact type locality of the typical race is unknown. "Vignales," the locality given, is a rather broad designation as we now understand it. The lesser race comes from the Sierra del Abra.

## KEY TO THE SUBSPECIES OF TURRITHYRA (TURRITHYRETES) ECHINULATA

Greater diameter more than 12 mm----- *echinulata*  
 Greater diameter less than 10 mm----- *echinella*

## TURRITHYRA (TURRITHYRETES) ECHINULATA ECHINULATA (Wright) Pfeiffer

## PLATE 14, FIGURE 11

1868. *Chondropoma echinulatum* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 10, pp. 184-185.

1920. *Chondrothyra* (*Chondrothyretes*) *echinulata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

This race, which Pfeiffer says Wright found under decaying leaves at "Vignales," has so far not been rediscovered by any subsequent collectors. It is abundantly represented in many collections but always dating back to Wright's collecting.

The shells are usually dark red, though at times paler individuals are present. Spiral color bands if present are scarcely noticeable. The shells are larger than those of the next subspecies.

The specimen figured, U.S.N.M. no. 10970, one of four, has 5.3 whorls remaining, and measures: Length, 21.1 mm; greater diameter, 12.8 mm; lesser diameter, 8.3 mm.

## TURRITHYRA (TURRITHYRETES) ECHINULATA ECHINELLA, new subspecies

## PLATE 14, FIGURE 10

This race was collected in the Sierra del Abra, 6 miles west of the River Cejanal in front of Enrique Veles's place, where it is found on bushes.

It is usually paler, with the spaces between the spiral cords darker than the cords and their spines. It is smaller than typical *T. (T.) echinulata echinulata*.

The type, U.S.N.M. no. 468683, has 4.9 whorls remaining and measures: Length, 17.7 mm; greater diameter, 9.0 mm; lesser diameter, 7.2 mm.

## TURRITHYRA (TURRITHYRETES) SINUOSA (Wright) Pfeiffer

Shell elongate-turreted, varying in color from white through pale yellow, through buff to reddish in ground color, unicolor or interruptedly spirally banded; peristome white or pale yellowish buff. Nuclear whorls about 2, inflated and strongly rounded, smooth except the last part of the last turn, which shows a few incremental lines. Postnuclear whorls also inflated and strongly rounded, separated by a well-constricted suture and marked by fairly regularly developed and spaced, retractively slanting, threadlike axial riblets crossed by



equal or heavier spiral threads, which are also of fairly regular spacing. The junctions of the axial and spiral threads form small rounded tubercles, some of which near the upper parts of the turns tend toward cusps. This sculpture also characterizes the inflated and well-rounded base, being even stronger here than on the spire. The base is openly umbilicated, the umbilical wall being sculptured like the adjacent area. Aperture large, very broadly ovate, with a slight angulation at the posterior angle. Peristome double, the outer broadly flaringly expanded, radially fluted and marked with concentric incremental lines, cut in the middle of the columellar side and having the posterior half reflected to partially cover the umbilicus; there is usually also a flexure in that of the outer lip a little anterior to the posterior angle, giving this part a somewhat channeled effect. The inner peristome is of much lesser extent; it is also reflected and adnate to the outer. Operculum thin, corneous, covered with a thin granular deposit.

The races of this species cluster about the road leading through the Puerta de la Ancon.

Distribution of the subspecies of *T. (T.) sinuosa* is shown in figure 83.

KEY TO THE SUBSPECIES OF TURRITHYRA (TURRITHYRETES) SINUOSA

Shell of red or reddish ground color----- vicina

Shell not of red or reddish ground color.

Shell of pale buff or white ground color.

Interrupted spiral bands conspicuous.

Axial and spiral threads numerous and crowded----- hutia

Axial and spiral threads less numerous and less crowded. \*

Greater diameter more than 13 mm----- sinuosa

Greater diameter less than 12 mm----- opposita

Interrupted spiral bands inconspicuous or absent----- rhachitica

TURRITHYRA (TURRITHYRETES) SINUOSA VICINA, new subspecies

PLATE 14, FIGURE 13

This race comes from the Sierra San Vicente and the Sierra Vinales where it joins the Sierra Vicente. It is particularly abundant on the walls of the Ensenada Delicia. It is a large subspecies of almost always red or reddish ground color with conspicuous slender interrupted spiral bands of brown. Peristome white, sometimes buff or even pale orange.

The type, U.S.N.M. no. 492724, comes from the Sierra Vinales; it has 5.5 whorls remaining and measures: Length, 26.0 mm; greater diameter, 15.8 mm; lesser diameter, 10.8 mm.

The red or reddish color is quite characteristic of this subspecies.

## TURRITHYRA (TURRITHYRETES) SINUOSA HUTIA, new subspecies

## PLATE 14, FIGURE 12

This subspecies, which Bartsch collected on Mogote Hutia, a limestone block on the east side of the center part of the Sierra de la Chorrera, differs from *T. (T.) sinuosa opposita* in having more and closer spaced spiral threads.

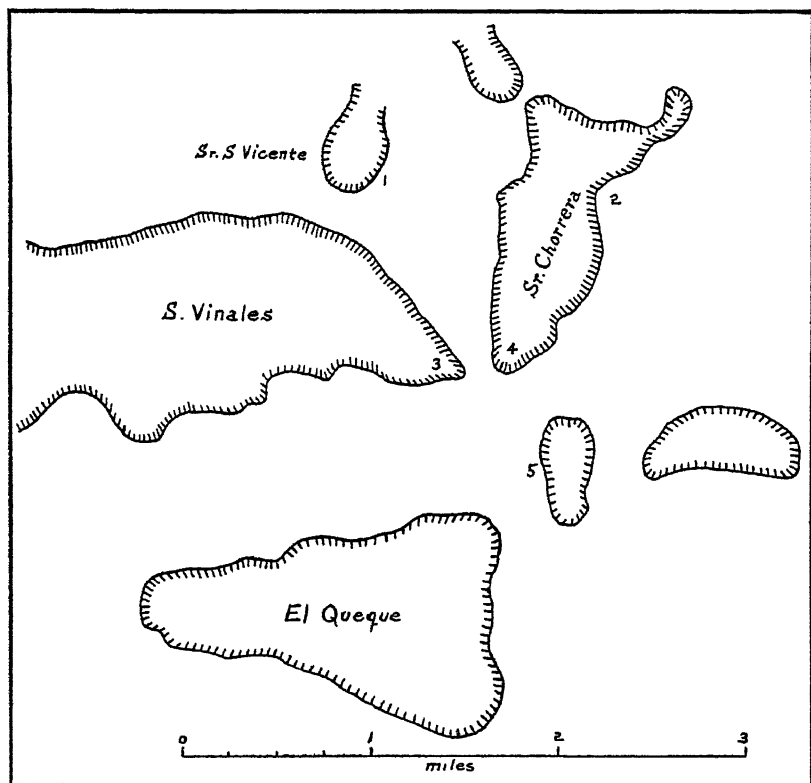


FIGURE 83. Distribution of the subspecies of *Turrithyra (Turrithyretes) sinuosa*: (1) *vicina*; (2) *hutia*; (3) *sinuosa*; (4) *opposita*; (5) *rhachitica*.

The type, U.S.N.M. no. 468732, has 4.5 whorls remaining and measures: Length, 18.8 mm; greater diameter, 11.0 mm; lesser diameter, 7.9 mm.

## TURRITHYRA (TURRITHYRETES) SINUOSA SINUOSA (Wright) Pfeiffer

## PLATE 14, FIGURE 16

1862. *Chondropoma sinuosa* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 10, p. 185.

1864. *Chondropoma sinuosa* PFEIFFER, Novitates conchologicae, vol. 1, p. 242, pl. 62, figs. 10, 11.

1920. *Chondrothyra* (*Chondrothyretes*) *sinuosa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

Pfeiffer, in his *Novitates conchologicae*, plainly figures the large shell of pale ground color with conspicuous interrupted dark bands, which occupies the west side of the Puerta de la Ancon. We have here collected hundreds of specimens that in every way agree with Pfeiffer's description and figure.

The specimen here figured, U.S.N.M. no. 57614, was collected by Arango at Vinales. It has 5.0 whorls remaining and measures: Length, 25.5 mm; greater diameter, 14.5 mm; lesser diameter, 11.0 mm.

**TURRITHYRA (TURRITHYRETES) SINUOSA OPPOSITA, new subspecies**

PLATE 14, FIGURE 15

This race occupies the opposing wall of the Puerta de la Ancon from that inhabited by typical *T. (T.) sinuosa sinuosa*, that is, the west wall of the Sierra de la Chorrera at the Puerta. It resembles typical *T. (T.) sinuosa sinuosa* but differs from it in being much smaller.

The type, U.S.N.M. no. 492723, has 4.6 whorls remaining and measures: Length, 21.7 mm; greater diameter, 12.0 mm; lesser diameter, 8.4 mm.

**TURRITHYRA (TURRITHYRETES) SINUOSA RHACHITICA, new subspecies**

PLATE 14, FIGURE 6

This race occupies Mogote Puertecitas, the block of limestone a little east of the southeastern end of the Sierra de la Chorrera. It is the smallest subspecies and it is likewise slenderer and practically always white; only an occasional specimen shows indications of interrupted spiral bands.

The type, U.S.N.M. no. 468733, is a complete specimen having 8.5 whorls and measures: Length, 21.3 mm; greater diameter, 8.5 mm; lesser diameter, 7.0 mm.

**TURRITHYRA, new subgenus**

Those *Turrithyras* that possess a breathing pore and have the reflected inner lip uncut.

Type: *Turrithyra* (*Turrithyra*) *canaliculata* (Gundlach) Pfeiffer.

**KEY TO THE SPECIES OF SUBGENUS TURRITHYRA**

Outer peristome broadly expanded.

Axial sculpture threadlike.

Spiral sculpture stronger than the axial..... *mendax*

Spiral sculpture not stronger than the axial..... *canaliculata*

Axial sculpture sublamellar..... deceptor  
 Outer peristome not broadly expanded..... hamlini

**TURRITHYRA (TURRITHYRA) MENDAX**, new species

PLATE 14, FIGURE 14

Shell elongate-turreted, white or yellow. Postnuclear whorls somewhat inflated, strongly rounded, marked by numerous retractively curved, slender, threadlike axial ribs, which extend undiminished across the periphery and base of the last whorl. The spiral sculpture consists also of slender threads, which are a little stronger than the axial; the combination of these elements lends the surface a fenestrated pattern. In the moderately open umbilicus the spiral threads are even stronger than those of the spire. Suture strongly constricted. Base inflated, well rounded. Aperture very broadly ovate; peristome double, the outer very broadly expanded and reflected, radially fluted and marked by concentric lines of growth; the inner only moderately expanded and reflected and adnate to the outer. Breathing pore at the posterior angle. Operculum thin, with a rather heavy deposit of granules which lend it a retractively fluted aspect.

The type, U.S.N.M. no. 468728, comes from the Cafetal de la Penitencia, Vinales. It has 4.5 whorls remaining and measures: Length, 21.4 mm; greater diameter, 12.5 mm; lesser diameter, 8.8 mm.

**TURRITHYRA (TURRITHYRA) CANALICULATA** (Gundlach) Pfeiffer

Shell elongate-turreted, red or reddish, with or without darker axial streaks and conspicuous or inconspicuous interrupted spiral bands of brown. Nuclear whorls smooth, excepting the last part of the last turn, which shows a few strong incremental lines. Postnuclear whorls inflated, strongly rounded, and marked by threadlike axial riblets and a little finer spiral threads, except on the umbilicus, where they are much stronger. The axial threads pass over the inflated, well-rounded periphery and base into the open umbilicus. Suture well constricted. Aperture broadly ovate; peristome double, the outer broadly expanded, somewhat auriculated at the posterior angle, radially fluted and marked by concentric lines of growth; the inner less widely expanded, reflected and adnate to the outer. Breathing pore on the parietal wall near the posterior angle of the aperture. Operculum covered on the inner two-thirds of its turn with a heavy granular, calcareous deposit in a retractively fluted pattern.

This species has several races, all of which cluster about Pan de Guajabon.

Distribution of the subspecies of *T. (T.) canaliculata* is shown in figure 84.

KEY TO THE SUBSPECIES OF *TURRITHYRA* (*TURRITHYRA*) *CANALICULATA*

- Shell with conspicuous axial brown streaks----- *pinalillensis*  
 Shell without conspicuous axial brown streaks.  
   Interrupted spiral brown bands conspicuous.  
     Axial riblets rather strong----- *andreas*  
     Axial riblets feeble----- *saguaensis*  
   Interrupted spiral brown bands inconspicuous----- *canaliculata*

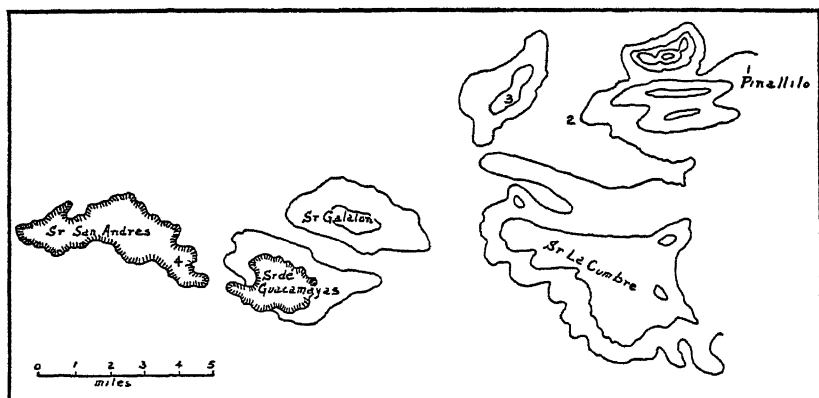


FIGURE 84.—Distribution of the subspecies of *Turrithyra* (*Turrithyra*) *canaliculata*: (1) *pinalillensis*; (2) *saguaensis*; (3) *canaliculata*; (4) *andreas*.

*TURRITHYRA* (*TURRITHYRA*) *CANALICULATA* *PINALILLENSIS*, new subspecies

## PLATE 14, FIGURE 1

This race is marked by brown varicial streaks, usually separated by bands of a little wider, of the orange-red base color. It also has inconspicuous brown spiral threads. The outer peristome is tinged with orange-red. It comes from Hato Pinalillo.

The type, U.S.N.M. no. 104500, has 5.3 whorls remaining and measures: Length, 23.5 mm; greater diameter, 12.8 mm; lesser diameter, 9.1 mm.

The dark varicial brown zones readily distinguish this subspecies from the other two.

*TURRITHYRA* (*TURRITHYRA*) *CANALICULATA* *ANDREAS*, new subspecies

## PLATE 14, FIGURE 3

This subspecies, which was collected by Dr. de la Torre at Pico Grande, Sierra San Andrés, has the rather strong axial riblets characteristic of *T. (T.) canaliculata pinalillensis* and interrupted spiral bands of brown narrower and not so strong as those of *T. (T.) canaliculata saguaensis*.

The type, U.S.N.M. no. 468852, has almost four whorls remaining and measures: Length, 20.2 mm; greater diameter, 12.0 mm; lesser diameter, 9.3 mm.

**TURRITHYRA (TURRITHYRA) CANALICULATA SAGUAENSIS, new subspecies**

PLATE 14, FIGURE 4

In this race the shell is marked by almost continuous, strong, brown spiral bands on both spire and base. These bands extend upon the peristome, which they mark radially; the rest of the peristome is white.

The type, U.S.N.M. no. 492719, we collected on the Tomas Barrera Expedition at Sagua, Pan de Guajaibon. It has 5 whorls remaining and measures: Length, 23.4 mm; greater diameter, 12.2 mm; lesser diameter, 9.3 mm.

The strong spiral banding and the absence of axial brown streaks characterize this subspecies.

**TURRITHYRA (TURRITHYRA) CANALICULATA CANALICULATA (Gundlach) Pfeiffer**

PLATE 14, FIGURE 2

1863. *Chondropoma canaliculata* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 10, pp. 183-184.

1920. *Chondrothya (Chondrothya) canaliculatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 187.

This race has the shell bright orange-red, unicolor or faintly interruptedly spirally banded. The peristome is of a little paler orange red color. It comes from Hato Caimito.

The specimen figured, U.S.N.M. no. 492718, was collected by Gundlach. It has 4.7 whorls remaining and measures: Length, 23.0 mm; greater diameter, 12.8 mm; lesser diameter, 8.8 mm.

The absence of strong interrupted spiral bands or dark axial streaks easily differentiates this from the other known subspecies.

**TURRITHYRA (TURRITHYRA) DECEPTOR (Arango)**

Shell elongate-turreted, ranging in coloration from flesh-color to bright rose-red, unicolor or marked by interrupted spiral threads of brown. The axial ribs are frequently of much lighter color than the rest of the shell. Peristome white, red, or reddish. Nuclear whorls 2, well rounded, smooth. Postnuclear whorls well rounded, marked by sublamellar, retractively slanting axial ribs which extend over the somewhat inflated and well-rounded periphery and base of the last whorl into the moderately open umbilicus. In addition to this sculpture, the whorls on spire and base are marked by numerous fine spiral

threads. On the umbilical wall the spiral threads become much intensified. Aperture broadly ovate. Peristome double, the outer broadly expanded and reflected, somewhat auriculated at the posterior angle, slightly radially fluted and marked by rather strong concentric incremental lines. Inner peristome only moderately expanded, reflected over and adnate to the outer. Breathing pore on the parietal wall near the posterior angle. Operculum with a rather heavy granular calcareous deposit on the inner two-thirds of the turns.

Races of this species are found from La Jagua south to the Costanera San Vicente.

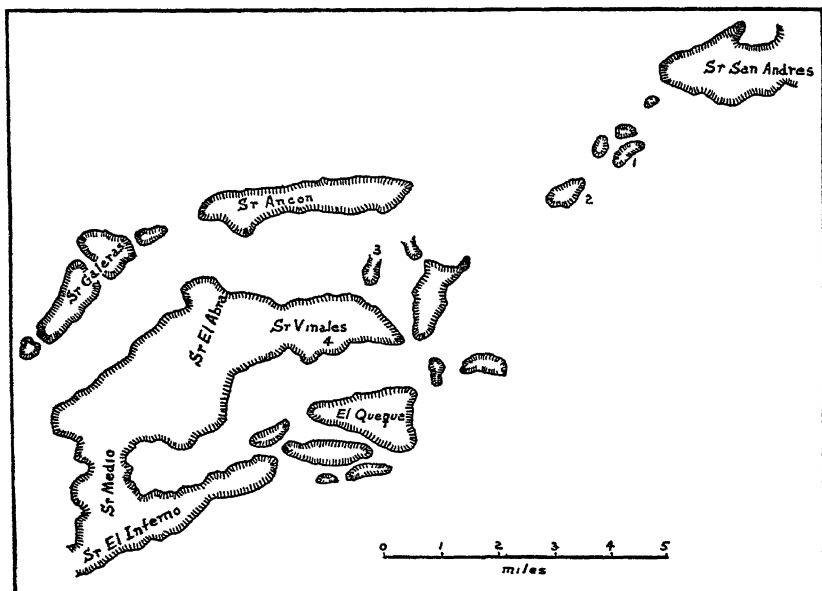


FIGURE 85.—Distribution of the subspecies of *Turrithyra* (*Turrithyra*) *deceptor*: (1) *deceptor*; (2) *persimilis*; (3) *vicentensis*; (4) *scalaris*.

Distribution of the subspecies of *T. (T.) deceptor* is shown in figure 85.

#### KEY TO THE SUBSPECIES OF TURRITHYRA (TURRITHYRA) DECEPTOR

- Shell conspicuously spirally banded..... *scalaris*  
 Shell not conspicuously spirally banded.  
     Spaces between spiral threads wider than threads.  
         Axial ribs paler than ground color..... *vicentensis*  
         Axial ribs not paler than ground color..... *persimilis*  
     Spaces between spiral threads not wider than threads..... *deceptor*

**TURRITHYRA (TURRITHYRA) DECEPTOR SCALARIS, new subspecies**

## PLATE 14, FIGURE 5

This race comes from the Sierra Vinales. Its shell and peristome are pale buff, marked by conspicuous, interrupted spiral bands of brown. The axial ribs and spiral threads here are also considerably stronger than in the other races.

The type, U.S.N.M. no. 492720, has 4.5 whorls remaining and measures: Length, 21.7 mm; greater diameter, 13.2 mm; lesser diameter, 9.7 mm.

**TURRITHYRA (TURRITHYRA) DECEPTOR VICENTENSIS, new subspecies**

## PLATE 14, FIGURE 7

This race is rather smaller than the others. The shells range in ground color from buff to bright red, and the peristome is equally variable, but regardless of what shade of coloration the shell may present the axial ribs are always paler than the rest of the shell. This easily distinguishes this subspecies from the rest.

It occupies the Costanera de San Vicente. The type, U.S.N.M. no. 492721, has 5.6 whorls remaining and measures: Length, 19.5 mm; greater diameter, 10.8 mm; lesser diameter, 7.3 mm.

**TURRITHYRA (TURRITHYRA) DECEPTOR PERSIMILIS, new subspecies**

## PLATE 14, FIGURE 9

This race comes from Encinar de Alto, frequently called La Mina. Its shell and peristome may be red or soiled white. The red form, while resembling *T. (T.) deceptor deceptor*, as well as the white shells, is easily distinguished from it by having a fewer number and less crowded spiral threads.

The type, U.S.N.M. no. 468730, has 5.0 whorls remaining and measures: Length, 24.2 mm; greater diameter, 13.7 mm; lesser diameter, 9.5 mm.

**TURRITHYRA (TURRITHYRA) DECEPTOR DECEPTOR (Arango)**

## PLATE 14, FIGURE 8

1882. *Chondropoma deceptor* ARANGO, Proc. Acad. Nat. Sci. Philadelphia, vol. 34, p. 105.

1920. *Chondrothyra (Chondrothyra) deceptor* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

This, the northern race of this species, comes from La Jagua, a mogote southwest of the western end of the Sierra San Andrés. It is



red-shelled with red peristome and has the spiral threads more numerous and closer spaced than the other known subspecies.

The specimen figured, U.S.N.M. no. 468729, is one of Arango's cotypes. It has 5.5 whorls remaining and measures: Length, 23.8 mm; greater diameter, 13.5 mm; lesser diameter, 9.2 mm.

**TURRITHYRA (TURRITHYRA) HAMLINI (Arango)**

Shell elongate-turreted of pale buff ground color, marked by interrupted spiral bands of brown, which may also join to form axial varicial streaks; peristome yellowish white. Nuclear whorls a little more than 2, large, strongly inflated and rounded, smooth, except for a few incremental lines on the last part of the last turn. Post-nuclear whorls also somewhat inflated and strongly rounded, marked on the early whorls by very slender, almost lamellar, rather closely spaced riblets, which on the last whorls are less elevated and more threadlike. These riblets extend over the inflated and strongly rounded periphery and base of the last whorl into the umbilicus. In addition to this, the whorls bear slender spiral threads, which at their junction with the axial riblets form conspicuous cusps on the early turns and rounded nodules on the later whorls, while the spaces enclosed between them are more or less squarish areolations. In the umbilicus the spiral threads are stronger than on the spire. Aperture subcircular, peristome double, the outer moderately broadly expanded and reflected, somewhat radially fluted and marked with incremental lines, the inner less expanded but also reflected and adnate to the outer. Operculum thin, corneous, covered with a minutely granulose calcareous deposit. Breathing pore on the parietal wall near the posterior angle of the aperture.

This species, as far as known, is restricted to the mogotes ranging about Kilometer 14, between Pinar del Rio and Luis Lazo.

**KEY TO THE SUBSPECIES OF TURRITHYRA (TURRITHYRA) HAMLINI**

- Cusps formed by junction of axial and spiral sculpture strong on later whorls..... xilaensis
- Cusps formed by junction of axial and spiral sculpture not strong on later whorls.
  - Dots of spiral bands usually forming axial bands..... cerroensis
  - Dots of spiral bands usually not forming axial bands..... hamlini

**TURRITHYRA (TURRITHYRA) HAMLINI XILAENSIS, new subspecies**

**PLATE 13, FIGURE 7**

This subspecies comes from Mogote de la Vega de Xila Couret near Mogote del Cerra. It differs from the other two in having the cusps formed by the junction of the axial and spiral sculpture much stronger on the later whorls; also in being paler and in having

the spots of the interrupted spiral bands very small and distantly spaced. The spiral threads in the umbilicus are also much weaker.

The type, U.S.N.M. no. 367902, has 4.5 whorls remaining and measures: Length, 13.7 mm; greater diameter, 7.3 mm; lesser diameter, 6.2 mm.

**TURRITHYRA (TURRITHYRA) HAMLINI CERROENSIS, new subspecies**

PLATE 13, FIGURE 6

In this subspecies, which comes from a mogote removed only a short distance from that occupied by *T. (T.) hamlini hamlini*, the interrupted spiral bands have the dots so broad and arranged in axial series and confluent that the shells appear more axially streaked than spirally banded.

The type, U.S.N.M. no. 468731, has 4.8 whorls remaining and measures: Length, 15.5 mm; greater diameter, 8.3 mm; lesser diameter, 7.0 mm.

**TURRITHYRA (TURRITHYRA) HAMLINI HAMLINI (Arango)**

PLATE 13, FIGURE 5

1882. *Chondropoma hamlini* ARANGO, Proc. Acad. Nat. Sci. Philadelphia, vol. 34, p. 105.

1920. *Chondrothyra (Chondrothyra) hamlini* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

In this race, which comes from the Mogote Cabrera on the north side of the road at Kilometer 14, between Pinar del Rio and Luis Lazo, the interrupted spiral bands, while arranged in axial series, do not fuse to form axial varicial streaks.

The specimen figured, U.S.N.M. no. 492722, has 4.8 whorls remaining and measures: Length, 15.4 mm; greater diameter, 8.8 mm; lesser diameter, 6.8 mm.

The animal is flesh-color, with a smoky suffusion. The faint pinkish flush shines through the forehead. The foot is medially cleft. Locomotion of the two sides is alternate.

**TURRIPOMA, new subgenus**

Those *Turrithyras* that have no breathing pore, whose peristomes are narrow and uncut.

Type: *Turrithyra (Turripoma) bermudezi*, new species.

**TURRITHYRA (TURRIPOMA) BERMUDEZI, new species**

PLATE 13, FIGURE 2

Shell elongate-turreted, pale brown, marked by axial zones of dark brown. Nuclear whorls 2, rather large, decidedly inflated, strongly

rounded, smooth. Postnuclear whorls also inflated and strongly rounded, marked by numerous, retractorily slanting, axial threads, which increase in strength with the whorls and form slender nodules where they join the much stronger spiral cords. The latter are of less than half the width of the spaces that separate them. Suture well constricted with white tufts of axial ribs crenulating them. Periphery and base inflated, strongly rounded; sculptured like the spire. Base openly umbilicated. Last whorl solute for one-tenth of a turn. Aperture broadly ovate; peristome double, the outer more broadly expanded on the inner lip than on the outer; inner peristome slightly expanded and reflected, adnate to the outer. There is no breathing pore. Operculum thin, corneous, with excentric nucleus covered on the inner half by a coarsely granular calcareous deposit.

The type, U.S.N.M. no. 367904, was collected by Dr. Bermudez on palms at the Cueva del Catre, Sierra del Paso Real de Guane. It has 5.2 whorls remaining and measures: Length, 17.0 mm; greater diameter, 7.4 mm; lesser diameter, 6.3 mm.

#### Genus CHONDROTHYRA Henderson and Bartsch

1920. *Chondrothyra* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell varying from ovate-conic to elongate-conic; marked by axial and spiral threads. Peristome broadly expanded in one plane; that is, not notched or inbent at the umbilicus. The breathing pore perforates the parietal wall a little behind the peristome and a little anterior to the posterior angle of the aperture. Operculum typically chondropomoid.

Type: *Cyclostoma egregium* (Gundlach) Pfeiffer.

#### KEY TO THE SUBGENERA OF GENUS CHONDROTHYRA

Outer peristome of inner lip without fold or pit.

Last whorl decidedly solute and descending..... *Hendersonoma*

Last whorl not decidedly solute or descending..... *Chondrothyra*

Outer peristome of inner lip with fold or pit.

Outer peristome of inner lip with a fold..... *Plicathyra*

Outer peristome of inner lip with a pit..... *Foveothyra*

#### HENDERSONOMA, new subgenus

*Chondrothyra* of gigantic size, with the last whorl decidedly solute for a tenth of a turn and descending. Peristome double, the outer thick, moderately expanded and reflected, much narrower on the parietal wall than on the rest of the aperture, somewhat channeled at the posterior angle. Inner peristome thick, narrowly expanded, reflected, and adnate to the outer.

The large size, solute and descending last whorl, and the fact that the outer peristome of the parietal wall is decidedly free from

the preceding whorl make this quite distinct from the other Chondrothyas.

Type: *Chondrothyra* (*Hendersonoma*) *percrassa* (Wright) Pfeiffer.

**CHONDROTHYRA (HENDERSONOMA) PERCRASSA (Wright) Pfeiffer**

**PLATE 15, FIGURE 6**

1864. *Licina?* *percrassa* (WRIGHT) PFEIFFER, Malakozool. Blätter, vol. 11, p. 157.

1920. *Chondrothyra* (*Chondrothyra*) *percrassa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell gigantic, chestnut-brown, the last whorl a little paler. Nuclear whorls unknown. Postnuclear whorls inflated, well rounded, marked by moderately strong spiral threads, which become enfeebled on the last whorl. These threads are a little narrower than the spaces that separate them. The axial sculpture consists of slender threads on the early postnuclear whorls, which become mere lines of growth on the middle whorls. On the last, faint axial impressed lines at more or less regular intervals are present that in combination with the reduced spiral sculpture lend a somewhat malleated effect to its surface. Suture well constricted. Periphery and base inflated, well rounded, the latter marked like the spire but with the sculpture still more reduced. The last whorl is decidedly solute and descending for about one-tenth of a turn. Aperture large, ovate, slightly channeled at the posterior angles. Peristome double, thick, the outer moderately broadly expanded and reflected on all but the parietal wall where it is narrow, somewhat fluted and marked with concentric threads; the inner is also thick, reflected and adnate to the outer. A breathing pore is present on the parietal wall near the posterior angle of the aperture, a little behind the edge of the peristome. Operculum unknown.

The specimen figured, U.S.N.M. no. 492739, was collected by Wright; it has 4.5 whorls remaining and measures: Length, 42.0 mm; greater diameter, 27.0 mm; lesser diameter, 21.4 mm.

This species Pfeiffer states was collected by Wright at "Luis Lazo, Vuelta Abajo." Arango, on the other hand,<sup>3</sup> says: "En la cima de las montanas de Luis Lazo."

It is to be hoped that this most magnificent form, the largest of all Cuban annularids, may soon be rediscovered and that the place we have assigned it in our present classification may prove correct.

**Subgenus CHONDROTHYRA Henderson and Bartsch**

1920. *Chondrothyra* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell elongate-ovate, openly umbilicate, varying in color from white through wax yellow, orange, brown, and even purplish, uni-

<sup>3</sup> Contribucion a la fauna malacologica Cubana, p. 19, 1873.

color, axially or spirally banded or both. Peristome broadly expanded in one plane, not cut on the inner lip, radiatingly fluted, marked by concentric lines of growth. Breathing pore present on the parietal wall, near the posterior angle of the aperture a little behind its edge. Operculum thin, usually covered more or less with a fine granular calcareous deposit.

Type: *Chondropoma egregia* (Gundlach) Pfeiffer.

#### KEY TO THE SPECIES OF SUBGENUS CHONDROTHYRA

Peristome white or yellowish.

Shell stout.

Greater diameter more than 17 mm..... *rutila*

Greater diameter less than 17 mm..... *egregia*

Shell not stout.

General color chestnut-brown..... *subegregia*

General color not chestnut-brown.

General color various, but not brown..... *tosta*

Peristome not white or yellowish.

Peristome blackish brown..... *atristoma*

#### CHONDROTHYRA (CHONDROTHYRA) RUTILA, new species

Shell large, elongate-ovate, with the whorls rather gibbous, with the apex and peristome white; the latter with or without dark radiating rays and axial band behind the peristome. The rest of the shell may be plain brilliant orange or clouded with dark axial zones, as well as spiral markings. Aperture large, broadly oval; peristome double, the outer broadly expanded, radiatingly fluted and marked with concentric laminae, the inner moderately expanded and exserted and adnate to the outer. Operculum thin, corneous, covered with a thick deposit of calcareous granules, which are heaviest on the inner margin and become less dense outwardly, disappearing before reaching the edge.

This species occupies the Mogote El Queque and the little mogote of Martin Miranda.

This differs from the red forms of *Chondrothyra* (*Chondrothyra*) *tosta* in having the sculpture finer.

#### KEY TO THE SUBSPECIES OF CHONDROTHYRA (CHONDROTHYRA) RUTILA

Shell unicolor..... *rutila*

Shell clouded..... *nebulosa*

#### CHONDROTHYRA (CHONDROTHYRA) RUTILA RUTILA, new subspecies

#### PLATE 17, FIGURE 3

Shell brilliant orange with a more or less strongly developed dark axial zone behind the peristome. The back of the peristome with

spiral rays, which may or may not show on the face of the peristome. The face of the peristome is pale yellow. Some specimens show a tendency toward interrupted spiral bands on the base.

The type, U.S.N.M. no. 468735, which comes from the Mogote El Queque, is a complete specimen having 7.8 whorls and measuring: Length, 29.7 mm; greater diameter, 17.8 mm; lesser diameter, 12.7 mm.

**CHONDROTHYRA (CHONDROTHYRA) RUTILA NEBULOSA, new subspecies**

PLATE 17, FIGURE 10

This subspecies, which comes from the small mogote Martin Miranda in the Palmarito, Vinales, near El Queque, has the ground color also orange, but this is decidedly clouded with axial streaks of blackish brown, and there is a tendency to spiral banding on the last whorl. A zone of more or less confluent spots is present on the summit of the whorls. The peristome is pale yellow and faintly radiatingly rayed.

The type, U.S.N.M. no. 468736, has 4.5 whorls remaining and measures: Length, 28.7 mm; greater diameter, 18.4 mm; lesser diameter, 13.0 mm.

The dark clouding readily distinguishes this subspecies from the other.

**CHONDROTHYRA (CHONDROTHYRA) EGREGIA (Gundlach) Pfeiffer**

PLATE 16, FIGURES 7, 9

1856. *Cyclostoma egregium* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 3, pp. 38-39.

1856. *Chondropoma egregium* PFEIFFER, Malakozool. Blätter, vol. 3, p. 134.

1920. *Chondrothyra (Chondrothyra) egregium* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell broadly ovate-conic, with the apex and the broadly expanded peristome white to pale yellow, the latter usually marked with radial streaks of brown on the outside. The rest of the shell may be orange or blackish brown; shells of both of these colors are present in the same colony. The shells may or may not be spirally banded. Nuclear whorls almost 2, rather small, well rounded, smooth except for microscopic granulations. The postnuclear whorls are somewhat inflated, well rounded. The first postnuclear whorl shows the beginning of the spiral threads which increase in number and strength as the shell advances in growth. In addition to these spiral threads, the whorls are marked by retractively curved axial threads, which are finer than the spiral and render the latter minutely granulose at their junction. The granuloseness becomes decidedly reduced on the last

whorl. On this and the whorl preceding, the pits between the axial and spiral sculpture give the shell a somewhat reticulated pattern. Suture moderately constricted, rendered slightly serrulate by the riblets on the summit of the turns, which form here a slender pale zone. Aperture broadly oval; peristome double, the outer decidedly flaringly expanded, slightly channeled at the posterior angle and marked by radial flutings and slender concentric laminae. The inner is but slightly expanded and reflected and adnate to the outer. Operculum thin, with the excentric nucleus covered by a calcareous granular deposit, which is arranged in a somewhat corrugated pattern, in which the corrugations have a retractive slant.

This species comes from Hato Caimito west of Pan de Guajaibon.

The specimens figured are U.S.N.M. no. 468692. The dark perfect individual figured has 7.1 whorls and measures: Length, 27.7 mm; greater diameter, 16.5 mm; lesser diameter, 11.5 mm.

Of this species Gundlach (*loc. cit.*, p. 134) says that the animal is pale rose-red, with the edge of the foot paler and the tentacles uniformly red.

**CHONDROTHYRA (CHONDROTHYRA) SUBEGREGIA, new species**

Shell elongate-ovate, orange or pale brown, with the peristome pale yellow, unicolor or marked with axial streaks of brown, which sometimes form slight fulgurations. Peristome wax yellow, conspicuously rayed with brown on the outer surface and sometimes on the inner. The early whorls are decollated in all our specimens. The postnuclear whorls are marked by slender spiral threads, which are less than half the width of the spaces that separate them, and retractively slanting axial threads of about the same strength, which on the last whorl, however, become quite evanescent. Suture well constricted, with the merest indication of denticulations at the summit of the whorls. Periphery and base inflated, well rounded, the latter umbilicated and marked like the spire. Aperture broadly oval; peristome double, the outer very broadly expanded, thin, decidedly lamellose and somewhat radially fluted, tending to the formation of a channel at the broadly expanded portion, which is reflected to partly close the umbilicus. Operculum thin with excentric nucleus covered by a heavy deposit of calcareous granules on the inner three-fourths, which is laid down in a more or less corrugated pattern.

There are two races of this species known: One from the Mogote de la Jagua and the other from the Sierra San Andrés.

**KEY TO THE SUBSPECIES OF CHONDROTHYRA (CHONDROTHYRA) SUBEGREGIA**

Surface shining; peristome radiatingly rayed..... *subegregia*  
Surface dull; peristome not radiatingly rayed..... *paterna*

## CHONDROTHYRA (CHONDROTHYRA) SUBEGREGIA SUBEGREGIA, new subspecies

## PLATE 16, FIGURE 4

This race, which comes from the Mogote de la Jagua, has the shell smaller and considerably brighter and more shining in color than *C. (C.) subegregia paterna*. It also has the outer expanded peristome conspicuously marked with radiating brown zones.

The type, U.S.N.M. no. 367838, has 3.8 whorls remaining and measures: Length, 24.3 mm; greater diameter, 17.7 mm; lesser diameter, 12.1 mm.

## CHONDROTHYRA (CHONDROTHYRA) SUBEGREGIA PATERNA, new subspecies

## PLATE 16, FIGURE 5

This race comes from the Sitio de la Sierra San Andrés. It differs from the preceding in having a duller surface and in being almost always without radiating brown zones on the outer peristome.

The type, U.S.N.M. no. 367842, has 4.5 whorls remaining and measures: Length, 28.0 mm; greater diameter, 19.3 mm; lesser diameter, 12.2 mm.

## CHONDROTHYRA (CHONDROTHYRA) TOSTA, new species

Shell ovate-conic, varying in color from white through wax yellow to orange to red, unicolor or banded, always with a dark zone behind the peristome, except *C. (C.) tosta lactea*, which is pure white. Nuclear whorls almost 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls marked by rather strong spiral threads and a little less strong and more closely spaced retractively slanting axial threads, which are most conspicuous between the spiral threads and render these minutely nodulose at their junction. The spaces enclosed between the axial and spiral threads are more or less rectangular, having their long axis parallel with the axial sculpture. Suture well constricted. The summit of the whorls being tightly appressed to the preceding turn, leaves an indication of a little narrow band, which is rendered feebly developed by the axial riblets. It should be understood that this is largely a mere indication. Periphery and base of the last whorl inflated and strongly rounded, the latter umbilicate and marked by the same type of sculpture as that which characterizes the spire. Aperture broadly oval, slightly angulated at the junction of the parietal wall with the outer lip, double. The outer broadly flaringly expanded, radially fluted and marked by feeble concentric laminae; the inner also expanded and appressed to the outer. Operculum thin, corneous, covered with a rather heavy deposit of



calcareous granules, which thins out toward the edge, leaving an uncovered zone on the outer fourth.

The animal of *C. (C.) tosta tosta* taken on the north side of the Chorrera near Banos San Vicente, was described by Bartsch in 1928, as follows: Animal short, smoky gray, paler around the base of the tentacles and the anterior portion of the snout. Tentacles coral-red, becoming paler toward the base. Foot longitudinally medially cleft. Locomotion alternate on the two sides.

The animal of *C. (C.) tosta lactea* also was described by Bartsch, as follows: Animal short, ashy gray; tentacles coral-red, brownish at the tip, flesh-colored at the base.

That of *C. (C.) tosta hesperia*, Bartsch described as follows: Body smoky gray, with the base of the tentacles and the edge of the snout flesh-color. The tentacles pass from flesh-color to pale brown to orange, the latter color constituting the major portion. It suspends itself by a mucous thread.

This species ranges from the Sierra de la Chorrera westward through the Organ Mountains to Pan de Azucar and the Sierra del Infierno. We must, however, except the Mogote El Queque and the Ensenada Palmaritas, where *C. (C.) rutila* holds forth.

Through this range the species breaks up into a series of subspecies, which the following key will help to differentiate:

Distribution of the subspecies of *C. (C.) tosta* is shown in figure 86.

KEY TO THE SUBSPECIES OF CHONDROTHYRA (CHONDROTHYRA) TOSTA

Axial dark zone behind peristome present.

Ground color white or pale yellow.

Shell moderately stout..... *tosta*

Shell slender..... *hesperia*

Ground color not white or pale yellow.

Ground color bright yellow or orange.

Entire shell yellow or orange..... *aurantia*

Entire shell not yellow or orange.

Last half whorl only deeply colored..... *pertosta*

Axial dark zone behind peristome absent..... *lactea*

CHONDROTHYRA (CHONDROTHYRA) TOSTA TOSTA, new subspecies

PLATE 15, FIGURES 2, 7

In this race, which inhabits the Ensenada de los Banos San Vicente, including the Sierra San Vicente, part of the Chorrera and part of the Sierra Vinales, the ground color is white or faintly yellowish. There is always a dark band even in the white shells immediately behind the peristome, which shines through the substance of the shell and tints the outer lip of the aperture at this place. The shells may also be banded with spiral zones of brown.

There is a particular tendency toward this on the Chorrera, where we frequently find shells with a brown band at the summit, one at the periphery and one on the middle of the base.

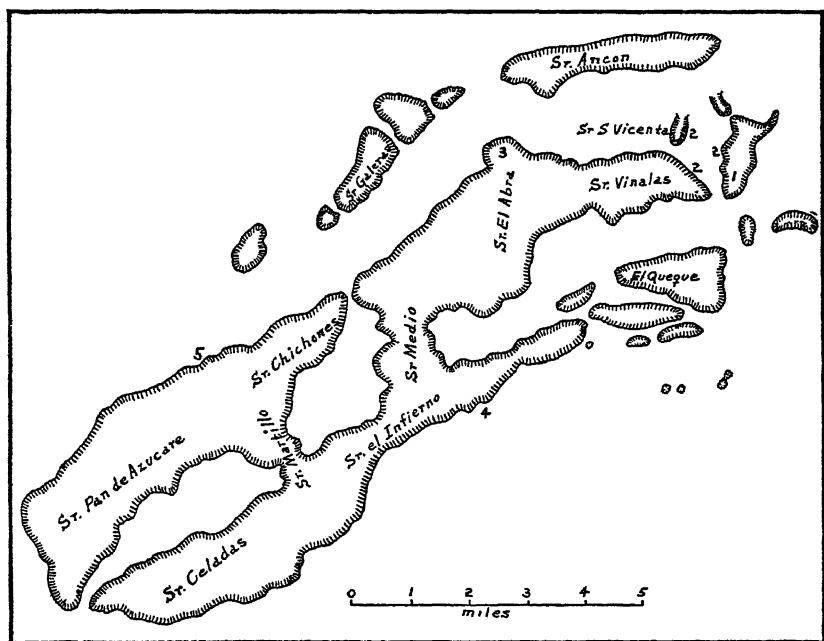


FIGURE 86.—Distribution of the subspecies of *Chondrothyra* (*Chondrothyra*) *tosta*: (1) *pertosta*; (2) *tosta*; (3) *lactea*; (4) *aurantia*; (5) *hesperia*.

The type, U.S.N.M. no. 492725, has 4.2 whorls remaining and measures: Length, 24.5 mm; greater diameter, 16.4 mm; lesser diameter, 11.8 mm. This was collected at Banos San Vicente.

We are also figuring a banded specimen from the Chorrera at Banos San Vicente.

**CHONDROTHYRA (CHONDROTHYRA) TOSTA HESPERIA, new subspecies**

PLATE 15, FIGURE 4

This subspecies, which comes from Pan de Azucar, resembles typical *C. (C.) tosta* but is smaller. The shells are white, with a dark axial zone behind the peristome. The last whorl behind this dark zone has a tendency toward becoming orange. This is usually faint although occasionally a specimen is found which is a little more pronouncedly orange.

The type, U.S.N.M. no. 492727, has 4.0 whorls remaining and measures: Length 24.5 mm; greater diameter, 16.1 mm; lesser diameter, 10.4 mm.

**CHONDROTHYRA (CHONDROTHYRA) TOSTA AURANTIA, new subspecies**

## PLATE 15, FIGURE 1

Ground color yellow or orange, with a conspicuous dark axial zone behind the peristome. The early whorls are always darker red than those immediately succeeding them. In most instances there is a broad zone of almost confluent spots at the summit. This, however, may be absent.

This race comes from the Sierras la Penitencia and Infierno and the mogotes near there.

The type, U.S.N.M. no. 468734, comes from El Cuajani between la Penitencia and El Infierno. It has 4.0 whorls remaining and measures: Length, 25.0 mm; greater diameter, 16.1 mm; lesser diameter, 11.3 mm.

**CHONDROTHYRA (CHONDROTHYRA) TOSTA PERTOSTA, new subspecies**

## PLATE 15, FIGURE 8

This race comes from the Hoyo de Jaruco at the summit of the southeastern part of the Sierra de la Chorrera. In it we have the shells much more brilliantly colored than in the typical race; that is, the early postnuclear whorls are yellow and the last one gradually changes to deep orange and finally to the purplish-black banding behind the peristome. There may be also faint axial streaks or stronger markings of dark.

The race is also somewhat smaller than the typical one.

The type, U.S.N.M. no. 367837, has 3.8 whorls remaining and measures: Length, 23.0 mm; greater diameter, 15.6 mm; lesser diameter, 11.2 mm.

This subspecies, while it resembles in a way *C. (C.) tosta aurantia*, is easily distinguished from this by its less orange coloration and the concentration of the red color to the last part of the last whorl.

**CHONDROTHYRA (CHONDROTHYRA) TOSTA LACTEA, new subspecies**

## PLATE 15, FIGURE 5

This subspecies, which comes from the Sierra del Abra, is pure white. There is not the faintest indication of a dark band behind the peristome.

The type, U.S.N.M. no. 492726, has 4.5 whorls remaining and measures: Length, 24.8 mm; greater diameter, 17.6 mm; lesser diameter, 11.4 mm.

## CHONDROTHYRA (CHONDROTHYRA) ATRISTOMA, new species

Shell elongate-ovate, with the tip and peristome blackish brown, the rest of the shell varying in the different subspecies from white through pale brown to dark brown. Interrupted spiral bands and axial streaks may or may not be present in some of the subspecies. Nuclear whorls almost 2, small, well rounded, smooth except for microscopic granulations. Postnuclear whorls moderately inflated, well rounded, marked by retractorily curved, slender, rather closely spaced, axial threads and spiral threads a little stronger than the axial. The junction of the two form minute nodules, while the spaces enclosed between them are more or less rectangular pits. The axial riblets become reduced on the last whorl. Suture moderately constricted with scarcely any indication of crenulations at the summit of the whorls. Periphery and base inflated and strongly rounded, the latter openly umbilicated and marked by the same type of sculpture that characterizes the spire. Aperture very broadly oval, slightly angulated posteriorly. Peristome double, the outer broadly expanded with a slight tendency to the formation of a channel at the umbilical region, which the broadly expanded peristome partly covers. The outer peristome is radially fluted and marked by concentric laminae. The inner peristome is slightly exserted and slightly reflected. Operculum thin with excentric nucleus covered with a rather heavy finely granulose deposit on the inner three-fourths of the turns.

This species appears peculiar to the Sierra San Andrés and the mogotes to the south of it.

We know at the present time three markedly distinct races, which the following key will help to differentiate:

Distribution of the subspecies of *C. (C.) atristoma* is shown in figure 87.

## KEY TO THE SUBSPECIES OF CHONDROTHYRA (CHONDROTHYRA) ATRISTOMA

Shell, except tip and peristome, chestnut-brown-----	<i>umbrata</i>
Shell, except tip and peristome, horn-color-----	<i>atristoma</i>
Shell, except tip and peristome, white-----	<i>luctifera</i>

## CHONDROTHYRA (CHONDROTHYRA) ATRISTOMA UMBRATA, new subspecies

## PLATE 16, FIGURE 3

The early remaining postnuclear whorls dark blackish brown, which gradually changes to chestnut-brown on the later turns. The peristome is dark blackish brown, with a little paler spot on the parietal wall near the posterior angle. The sculpture is that of the species, but the lamellae on the outer peristome are particularly strong here.

This race comes from Pico Grande, Sierra San Andrés.

The type, U.S.N.M. no. 468695, has 4 whorls remaining and measures: Length, 23.1 mm; greater diameter, 16.2 mm; lesser diameter, 11.4 mm.

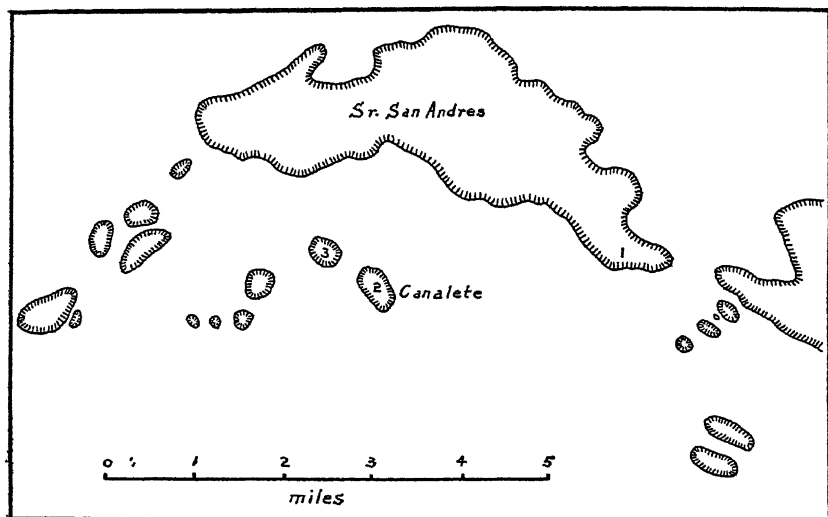


FIGURE 87.—Distribution of the subspecies of *Chondrothyra* (*Chondrothyra*) *atristoma*: (1) *umbrata*; (2) *luctifera*; (3) *atristoma*.

**CHONDROTHYRA (CHONDROTHYRA) ATRISTOMA ATRISTOMA, new subspecies**

PLATE 16, FIGURE 1

Shell broadly ovate, the first fraction of the first whorl white, the rest of the nuclear turns and the three first postnuclear turns dark blackish brown. The remaining postnuclear whorls dark horn-brown, frequently with an interrupted zone of spots near the summit and on the base. The broadly expanded peristome and the outer edge of the inside of the peristome purplish, blackish brown, except for a little spot on the parietal wall near the posterior angle, which is paler. The sculpture is that characteristic of the species.

This race comes from the Abra de Bejarano, Mogote El Canalete.

The type, U.S.N.M. no. 468693, a perfect specimen, has 7.1 whorls and measures: Length, 27.8 mm; greater diameter, 16.9 mm; lesser diameter, 11.8 mm.

**CHONDROTHYRA (CHONDROTHYRA) ATRISTOMA LUCTIFERA, new subspecies**

PLATE 16, FIGURE 2

In this subspecies the tip of the shell is dark and so is the peristome, while the rest of the shell is white or pale yellowish, giving it a decidedly mourning effect. The sculpture is that typical of the species.

This race comes from Mogote del Canalete, south of the Sierra San Andrés.

The type, U.S.N.M. no. 468697, has 4.5 whorls remaining and measures: Length, 21.6 mm; greater diameter, 14.2 mm; lesser diameter, 9.9 mm.

PLICATHYRA, new subgenus

Shell similar to *Chondrothyra* as far as general shape and sculpture are concerned, differing markedly from this, however, by having the outer peristome of the inner lip so bent as to form a fold.

Type: *Chondrothyra (Plicathyra) uniplicata*, new species.

KEY TO THE SPECIES OF SUBGENUS PLICATHYRA

Shell elongate-ovate.

Shell dark and rather heavy.

Sculpture of last whorl strong----- *uniplicata*

Sculpture of last whorl feeble----- *crassa*

Shell pale and rather thin----- *wrighti*

CHONDROTHYRA (PLICATHYRA) UNIPLICATA, new species

PLATE 16, FIGURE 6

Shell large, elongate-ovate, rather thin. Nuclear whorls buff. Post-nuclear whorls chestnut-brown, except the peristome and the margin of the lip, which are white. Nuclear whorls 2, strongly rounded, smooth except for microscopic granules and the beginning of the spiral threads on the last portion of the last whorl. Postnuclear whorls inflated, strongly rounded, marked by spiral threads and retractively curved axial riblets, which become a little weaker and more closely spaced as the shell increases in size. The junctions of these two elements form small nodules, which are strongest on the middle whorls, while the spaces enclosed between them are squarish on the early whorls and oblong on the last whorl where their long axis coincides with the axial sculpture. The summit of the whorls is appressed and usually shows as a pale line. Periphery and base inflated, well rounded. On the latter the axial and spiral sculpture are both stronger than on the spire. The base is half openly umbilicated. Aperture broadly oval, slightly angulated posteriorly. Peristome double, the outer broadly expanded, somewhat channeled at the posterior angle, more than double the width of that of the outer lip on the posterior half of the inner lip, somewhat radially fluted and marked with strongly developed, wavy, concentric lamellae. The middle of the outer peristome of the inner lip is bent by a partial fold. Inner peristome somewhat exerted and slightly expanded. Operculum thin, corneous, covered with a heavy deposit of calcareous granules, which extend to its edge.

The type, U.S.N.M. no. 468739, comes from the large mogote at Cayo San Felipe. It is a perfect specimen having 6.8 whorls and measures: Length, 24.8 mm; greater diameter, 14.4 mm; lesser diameter, 10.7 mm.

The animal of this species is ash-gray, with the tentacles coral-red, their base being a little paler, gradually passing into flesh-color at their origin. Snout flesh-color at tip. Sole of foot flesh-color with smoky suffusion. Foot medially longitudinally cleft; motion of the two sides alternate.

This species resembles certain forms of *Chondrothyretes* (*Chondrothyretes*) *reticulata*, but the absence of a definite cut in the inner lip of the outer peristome and open umbilicus easily mark its distinction.

CHONDROTHYRA (PLICATHYRA) CRASSA, new species

PLATE 15, FIGURE 3

Shell large (early whorls unknown); peristome double, the inner slightly exerted, somewhat expanded; the outer strongly expanded and radiately fluted, the inner lip broader than the outer and adnate to the preceding whorl. The color varies from unicolor yellowish white to dark chestnut-brown, or it may be spirally banded or interruptedly so; in the latter case there is usually an axial arrangement of spots as well as a spiral. Operculum typically chondropomoid.

The type, U.S.N.M. no. 367848, has 3.2 whorls remaining and measures: Length, 31.9 mm; greater diameter, 22.0 mm; lesser diameter, 16.0 mm.

This species comes from the high summits of the Sierra San Carlos between Luiz Lazo and Sumidero. Its large size will readily distinguish it from *C. (P.) uniplicata*, its nearest ally.

CHONDROTHYRA (PLICATHYRA) WRIGHTI, new species

PLATE 16, FIGURE 8

Shell rather large, thin, of pale-yellow ground color with numerous interrupted spiral bands of brown, which are also arranged in axial series. These bands are present on both spire and base. The axial arrangement is slightly retractive. The early whorls are decollated in the unique type. Suture feebly denticulated by the axial riblets but well constricted. Periphery strongly rounded. Base moderately long, well rounded. The remaining whorls are slightly inflated, well rounded, and marked by fine, retractively slanting, closely spaced, axial threads, which are about half as wide as the spaces that separate them, and spiral lirations, which are slightly stronger than the axial threads and a little more distantly spaced. The junction of these two elements forms weak nodules, while the spaces enclosed

between them are more or less squarish or rectangular shallow pits. This sculpture holds good also for the base, except that here the axial threads become a little more approximated and the spiral lirations are a little stronger. Aperture broadly ovate; peristome double, the inner slightly excavated, reflected and adnate to the outer, which is very broadly flaringly expanded, slightly fluted and marked by slender concentric lamellae. The outer peristome on the inner lip is reflected in its middle to form a fold, not cut. Posterior to this it is reflected over the base so as to almost close the umbilicus, leaving only a narrow chink. On the parietal wall the inner lip extends partly on the base and forms somewhat of an auricle at its junction with the outer lip at the posterior angle.

The type, U.S.N.M. no. 10981, was collected by Wright at La Guira, a place east of the Sierra San Carlos. It has 4.3 whorls remaining and measures: Length, 27.4 mm; greater diameter, 17.8 mm; lesser diameter, 12.6 mm.

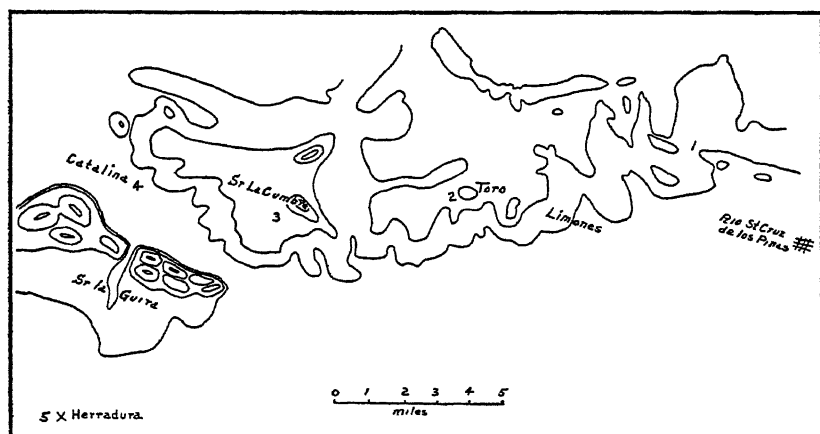


FIGURE 88.—Distribution of the species and subspecies of *Foveothyra*: (1) *C. (F.) foveata foveata*; (2) *foveata toroensis*; (3) *cumbrensis cumbrensis*; (4) *cumbrensis catharina*; (5) *natensoni*.

#### FOVEOTHYRA, new subgenus

Shell like *Chonodrothyra*, but with the posterior part of the outer peristome of the inner lip punched into the umbilicus, thus forming here a decided pit.

Type: *Chondrothyra (Foveothyra) foveata* (Gundlach) Pfeiffer.

Distribution of the species and subspecies of the subgenus *Foveothyra* is shown in figure 88.

#### KEY TO THE SPECIES OF SUBGENUS FOVEOTHYRA

Shell more than 23.0 mm in length..... *foveata*  
 Shell less than 15.0 mm in length..... *natensoni*  
 Shell 16–19 mm in length..... *cumbrensis*



## CHONDROTHYRA (FOVEOTHYRA) FOVEATA (Gundlach) Pfeiffer

Shell elongate-conic, white or orange, unicolor or faintly spirally banded. Peristome white or pale yellow. Nuclear whorls almost 2, inflated, strongly rounded, smooth except for fine microscopic granules. Postnuclear whorls also inflated, strongly rounded, and marked by closely spaced, very slender, sublamellar, retractively slanting, axial riblets, which are about one-half the width or less than the spaces that separate them and which render the summits of the whorls minutely crenulated. The spiral sculpture consists of threads of about the same strength as the axial lamellae, but not so elevated, which are of almost the same spacing as the axial riblets. The junction of the spiral threads with the axial riblets renders the latter slightly sinuose and minutely nodulose. Suture well constricted; periphery and base inflated, strongly rounded, the latter marked like the spire with the spiral threads a trifle stronger on the umbilical wall. Aperture broadly oval, slightly angulated posteriorly. Peristome double; the outer very broadly flaringly expanded and marked by poorly developed radial flutings and very slender, weak, concentric lamellae. On the parietal wall this outer peristome is inpinched, and over the umbilical region it is deeply pittedly impressed, completely closing and plugging the umbilicus. The inner peristome is slightly exserted and adnate to the outer, projecting only a trifle above this. Operculum thin, corneous with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules, which become thinner toward the margin, vanishing before reaching this.

This species comes from Santa Cruz de las Pinas and El Toro, Sierra de Limones.

## KEY TO THE SUBSPECIES OF CHONDROTHYRA (FOVEOTHYRA) FOVEATA

Shell slender----- foveata  
Shell stout----- toroensis

## CHONDROTHYRA (FOVEOTHYRA) FOVEATA FOVEATA (Gundlach) Pfeiffer

## PLATE 17, FIGURE 9

1863. *Chondropoma foveatum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 10, pp. 185-186.

1920. *Chondrothyra* (*Chondrothyretes*) *foveatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

This subspecies is pale wax yellow with white peristome, marked by obscure interrupted spiral lines of brown. The peristome is much slenderer than in the next species and has the whorls less inflated and the sculpture considerably reduced on the last whorl and not nearly so prominent on all the whorls.

It comes from Rio Santa Cruz de los Pinas.

The specimen figured, U.S.N.M. no. 492728, lacks the nuclear whorls. It has 5.3 whorls remaining and measures: Length, 24.3 mm; greater diameter, 15.9 mm; lesser diameter, 9.6 mm.

**CHONDROTHYRA (FOVEOTHYRA) FOVEATA TOROENSIS, new subspecies**

PLATE 17, FIGURE 11

In this race, which comes from El Toro of the Sierra de Limones, the shell is pale chestnut-brown, with the peristome pale yellow. Faint interrupted spiral lines of brown are present also. The whorls in this race are much more inflated than in the typical race, and the sculpture is in every way much stronger and more pronounced.

The type, U.S.N.M. no. 492729, has 4.8 whorls remaining and measures: Length, 23.5 mm; greater diameter, 15.8 mm; lesser diameter, 10.5 mm.

**CHONDROTHYRA (FOVEOTHYRA) NATENSONI, new species**

PLATE 17, FIGURE 8

Shell small, elongate-ovate, pale yellow, with faint interrupted spiral bands. Nuclear whorls 2, well rounded, smooth, marked with microscopic granulations. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, sublamellar axial riblets, which are somewhat thickened at the summit and render this slightly crenulated. These threads are rather closely spaced, being about half as wide as the spaces that separate them on the last turn. In addition to this, the whorls are marked by slender spiral threads, which are less than half the width of the spaces that separate them. These render the axial riblets slightly sinuose and feebly nodulose. This sculpture also obtains on the inflated and well-rounded base. Operculum oval; peristome double, the outer flaringly expanded, deeply pitted at the umbilical region and forming a channel on the parietal wall between the inner lip and the parietal wall. The inner peristome is exserted and slightly reflected. Operculum paucispiral, thin, covered with a thick granular calcareous deposit.

The type, U.S.N.M. no. 468738, was collected by Natenson at the Entronque de Herradura. It has 4 whorls remaining and measures: Length, 14.2 mm; greater diameter, 9.3 mm; lesser diameter, 6.8 mm.

The small size will easily distinguish this from the other species.

**CHONDROTHYRA (FOVEOTHYRA) CUMBRENSIS, new species**

Shell ovate, wax yellow with interrupted spiral bands of brown. The nuclear whorls are decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked with sublamellar, retrac-

tively slanting, axial riblets, which develop into slender cusps at the appressed summit and fine spiral threads, which render the axial riblets slightly sinuose and somewhat thickened at their junction. This sculpture extends over the inflated, strongly rounded, periphery and base. Aperture ovate, slightly angulated posteriorly. Peristome double, the outer very broadly flaringly expanded, somewhat radially fluted and marked with concentric lines of growth; the inner decidedly exserted, scarcely at all reflected. The space between the parietal wall and the inner peristome is rather broad and is covered by the outer peristome which is here inpinched to form a decided channel, terminating in the deep pit, which plugs the umbilicus. Operculum paucispiral, covered with a rather heavy calcareous granular deposit, which thins out toward the edge and disappears before reaching this.

This species differs from *C. (F.) foveata* in being shorter and more ovate and in having the space between the inner lip and the parietal wall much more deeply impressed.

It comes from La Cumbre Mountain and from Los Cayitos la Catalina north of San Diego Banos, the two localities representing distinct subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF *CHONDROTHYRA* (FOVEOTHYRA) *CUMBRENSIS*

Interrupted spiral bands very strong----- *cumbrensis*  
Interrupted spiral bands feeble----- *catharina*

*CHONDROTHYRA* (FOVEOTHYRA) *CUMBRENSIS CUMBRENSIS*, new subspecies

PLATE 17, FIGURE 6

Shell varying considerably in size with the whorls inflated, strongly rounded, and marked by rather pronounced interrupted spiral zones on spire and base. These zones are also conspicuous on the outer peristome of the last whorl, which here is unusually broad.

The type, U.S.N.M. no. 492730, was collected by John B. Henderson in the Sierra la Cumbre. It has 4.3 whorls remaining and measures: Length, 18.2 mm; greater diameter, 14.2 mm; lesser diameter, 9.3 mm.

*CHONDROTHYRA* (FOVEOTHYRA) *CUMBRENSIS CATHARINA*, new subspecies

PLATE 17, FIGURE 7

This race averages smaller with the interrupted spiral bands narrower and fainter and scarcely indicated on the outer peristome. The umbilical pit here is unusually deep.

The type, U.S.N.M. no. 468737, comes from Los Cayitos la Catalina north of San Diego Banos. It has 5 whorls remaining and measures: Length, 16.2 mm; greater diameter, 11.7 mm; lesser diameter, 7.2 mm.

Genus **CHONDROTHYRETES** Henderson and Bartsch

1920. *Chondrothyra* (*Chondrothyretes*) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

Shell varying from ovate-conic to ovate-turreted, marked with axial and spiral threads. Aperture varying from ovate to subcircular; peristome double, the outer usually broadly expanded and reflected, always deeply cut on the inner lip, with the part posterior to the cut reflected over the umbilicus, which is completely or almost completely closed; inner peristome short, reflected and adnate to the outer. A breathing pore is present, which may open directly to the exterior or through a connecting channel communicating with the exterior by way of the hollow truncated axis. Operculum paucispiral with ex-centric nucleus covered to a varying degree with a deposit of fine calcareous granules.

Type: *Chondrothyretes shuttleworthi* (Pfeiffer).

The main distribution of the members of this genus falls into Pinar del Rio Province; a few species, however, extend eastward into Havana Province.

KEY TO THE SPECIES OF GENUS CHONDROTHYRETES

Shells of medium size, thin.

Outer peristome of inner lip, above cut, pressed into umbilicus\_\_\_\_\_ *impressa*

Outer peristome of inner lip, above cut, not pressed into umbilicus\_\_\_\_\_ *delectabilis*

Shell large and heavy.

Spiral sculpture decidedly stronger than axial.

Hydrophanous axial streaks present\_\_\_\_\_ *affinis*

Hydrophanous axial streaks absent.

Axial sculpture of last whorl quite strong\_\_\_\_\_ *gundlachi*

Axial sculpture of last whorl feeble\_\_\_\_\_ *parilis*

Spiral sculpture not decidedly stronger than axial.

Junctions of axial riblets and spiral threads forming prominent nodules.

Outer lip conspicuously rayed\_\_\_\_\_ *tenebrata*

Outer lip not conspicuously rayed\_\_\_\_\_ *reticulata*

Junctions of axial riblets and spiral threads not forming prominent nodules.

Axial and spiral sculpture moderately strong.

Outer peristome thin, broadly expanded.

Shell ponderous\_\_\_\_\_ *barbouri*

Shell not ponderous\_\_\_\_\_ *shuttleworthi*

Outer peristome thickened, not broadly expanded\_\_\_ *incrassata*

Axial and spiral sculpture obsolete\_\_\_\_\_ *cerina*

## CHONDROTHYRETES SHUTTLEWORTHII (Pfeiffer)

Pfeiffer, in describing *Cyclostoma shuttleworthi*, does not mention a type locality for his species, but in his reference to it in the *Monographia pneumonopomorum* in 1852, page 295, he states that his specimen was in the Cumings Museum. His figure in Martini-Chemnitz Conchylien Cabinet, plate 36, figure 7, and also the description on pages 265-266, leave no doubt in our minds that this specimen is one of the San Diego Banos complex. Poey, in describing *Cyclostoma verecundum* in his *Memorias sobre la historia natural de la Isla de Cuba*, volume 1, pages 102-103, says that his specimens were received from D. Jose Maria Velasquez who collected them at San Diego de los Banos.

Henderson and Simpson's exhaustive collecting in the region of San Diego Banos in 1913, Bartsch's in 1928, as well as the more recent collecting by Bermudez, Aguayo, and Natenson, have resulted in the accumulation of a mass of material with definite localities, which enable us to fairly adequately understand the distribution of this species and its breaking up into a definite series of zoogeographic races, which we are designating as subspecies.

These here, as elsewhere, have their definite physical limitations and are undoubtedly segregation products, the results of erosion and the isolation caused thereby.

The species is confined to the Pinar del Rio Province and ranges from San Diego Banos northward to the Sierra la Cumbre and La Catalina, east of the Rio San Diego. It extends westward through the mogotes facing the Sierra la Guira, as well as this sierra, then westward through the Sierra Guacamayas, and from there southward to Mogote Mamey.

Shell ovate, varying from medium to rather large in size, varying in ground color from flesh-color, through straw-color, through yellow to orange and brown in different individuals, always with some spiral markings. These may constitute definite bands or interrupted lines, which if seeming absent are at least expressed as rays upon the expanded peristome. The interrupted spiral markings are at times so arranged as to constitute axial zones. Nuclear whorls about 2, inflated, strongly rounded, smooth except the last portion of the last whorl, which shows the feeble beginning of the postnuclear sculpture. A small dark patch marks the suture of the first nuclear turn. Postnuclear whorls inflated, gibbose, marked by numerous, about equal, and equally spaced axial and spiral threads, which in one group of subspecies retain their strength on the last turn, while in another group we find the axial threads decidedly reduced. Suture moderately

constricted with but the merest suggestion of obsolete denticulations at the summit of the whorls. Periphery inflated, strongly rounded. Base rather short, inflated, and rounded and marked like the spire. Aperture broadly ovate; peristome double, the inner slightly exerted and reflected; the outer broadly flaringly expanded, fluted, and marked by concentric threads, cut in the middle of the inner lip almost to the inner peristome, the posterior half being reflected over the umbilicus and parietal wall as a strong callus; parietal wall also covered with an extensive callus. Operculum paucispiral with excentric nucleus, having the last whorl covered with a heavy granular calcareous deposit.

Of the animal we have the following notes:

Of *C. shuttleworthi shuttleworthi* the sides of body, sole of foot, and tip of snout are pale smoky gray, the upper portion being darker. Base of tentacles surrounded by a white ring, the rest crimson; the lateral edges of the expanded tip are smoky. Sole of foot medially cleft; locomotion of the two sides alternate.

The animal of *C. shuttleworthi portica* is smoky gray with a buff tinge, the edge and sole of the foot pale buff, which is also the color of the tip of the snout. Tentacles with a flesh-colored ring about the base, the rest crimson except for the slightly expanded distal portion, which is smoky on the sides. The internal pink anatomy shines slightly through the integument behind the tentacles. Foot medially cleft; locomotion of the two sides alternate.

The animal of *C. shuttleworthi atriola* is smoke gray, being a little darker on top than on the sides. There is a white ring about the tentacles at their base, the rest being bright red, except for the slightly expanded distal portion, which has a yellow tinge, the tip of the snout being slightly paler. The sole of the foot is longitudinally cleft, pale smoke-gray.

The animal of *C. shuttleworthi clivicola* is pale smoke-gray. Tentacles almost sooty with a subterminal paler band. Snout a little paler than the general coloration of the body; edge of the body at the junction of the foot flesh-color. Sole of the foot flesh-color, with a faint smoky suffusion. The internal anatomy shines through the body wall behind the tentacles with a rosy flush. The short foot is medially deeply cleft, progression being alternate by the two sides.

Distribution of the subspecies of *C. shuttleworthi* is shown in figure 89.

KEY TO THE SUBSPECIES OF *CHONDROTHYRETES SHUTTLEWORTHII*

Axial sculpture of last whorl less strong than spiral.

Greater diameter more than 16 mm.

Inner peristome greatly expanded and thickened..... *cumbrensis*

Inner peristome not greatly expanded and thickened.

Decollated shell with 3.5 whorls..... *shuttleworthi*

Decollated shell with 4.5 whorls..... *portica*

Greater diameter less than 15 mm.

Back of outer peristome broadly rayed..... *atriola*

Back of outer peristome not broadly rayed..... *mameyensis*

Axial sculpture of last whorl as strong as spiral.

Whorls gibbose.

Greater diameter more than 15 mm..... *clivicola*

Greater diameter less than 15 mm..... *catalinensis*

Whorls not gibbose..... *perplexa*

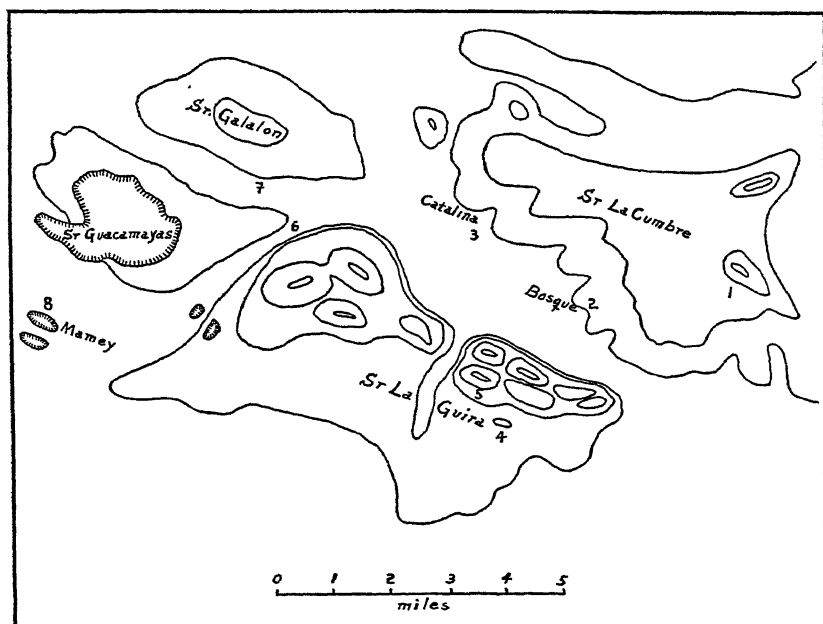


FIGURE 59.—Distribution of the subspecies of *Chondrothyretes shuttleworthi*: (1) *cumbrensis*; (2) *clivicola*; (3) *catalinensis*; (4) *shuttleworthi*; (5) *perplexa*; (6) *portica*; (7) *atriola*; (8) *mameyensis*.

*CHONDROTHYRETES SHUTTLEWORTHII CUMBRENSIS*, new subspecies

PLATE 19, FIGURE 5

Shell similar in size and shape to *C. shuttleworthi shuttleworthi*, but with the inner peristome broadly expanded, much thickened, and reflected over half of the outer.

The type series of specimens were collected by John B. Henderson in the Sierra la Cumbre north of San Diego Banos, east of the Rio

San Diego. The type, U.S.N.M. no. 493294, has 3.5 whorls remaining and measures: Length, 25.6 mm; greater diameter, 17.4 mm; lesser diameter, 13.7 mm.

**CHONDROTHYRETES SHUTTLEWORTHII SHUTTLEWORTHII (Pfeiffer)**

PLATE 19, FIGURE 9

1851. *Cyclostoma shuttleworthii* PFEIFFER, Proc. Zool. Soc. London, 1851, p. 246.

1851. *Cyclostoma verecundum* POEY, Memorias sobre la historia natural de la Isla de Cuba, pp. 102-103, 106, 144, pl. 7, figs. 5-7.

The typical subspecies ranges from San Diego de los Baños west through the mogotes leading to the Sierra la Guira, this sierra, and the Abra de Caiguanabo. It is a large shell, of stumpy appearance, with inflated swollen whorls having the axial riblets reduced on the last whorl; the shell is thereby given a somewhat smooth appearance. The shell is almost always decollated, leaving about 3.5 whorls remaining. It is very variable in coloration, presenting all the variations mentioned under the species.

The specimen figured, U.S.N.M. no. 492867, was collected by John B. Henderson at the mogote next to the Sierra la Guira. It is a perfect specimen, having 7.0 whorls and measuring: Length, 26.1 mm; greater diameter, 15.9 mm; lesser diameter, 12.6 mm.

**CHONDROTHYRETES SHUTTLEWORTHII PORTICA, new subspecies**

PLATE 19, FIGURE 7

This subspecies ranges from the mogotes Abra de Caiguanabo to Los Portales.

This race is smaller than the typical one. It is more strongly sculptured and less inflated, and the decollated shell usually has 4.5 whorls. It always averages darker in coloration and is usually more heavily banded.

The type, U.S.N.M. no. 468881, is a complete specimen and is rather large for the subspecies. We have selected it on account of its completeness. It comes from Los Portales. It has 7.2 whorls remaining and measures: Length, 28.8 mm; greater diameter, 16.8 mm; lesser diameter, 12.2 mm.

**CHONDROTHYRETES SHUTTLEWORTHII ATRIOLA, new subspecies**

PLATE 19, FIGURE 8

This is a small race that comes from Los Portales, about Espejo Cueva Oscura, and the Mogote Galalón. It frequently is bright red in color, and the back of the expanded peristome is conspicuously broadly rayed.



The type, U.S.N.M. no. 468886, has 4.2 whorls remaining and measures: Length, 22.2 mm; greater diameter, 15.7 mm; lesser diameter, 10.9 mm.

**CHONDROTHYRETES SHUTTLEWORTHII MAMEYENSIS, new subspecies**

PLATE 18, FIGURE 8

This race comes from the Mogote Mamey, the northern one of the two hills about 2 miles south of the gap that separates the Sierra San Andrés from the Sierra Guacamayas. It is a small, pale, thin-shelled race, narrowly rayed on the back of the outer peristome.

The type, U.S.N.M. no. 468889, has 5.0 whorls remaining and measures: Length, 21.0 mm; greater diameter, 14.0 mm; lesser diameter, 10.2 mm.

**CHONDROTHYRETES SHUTTLEWORTHII CLIVICOLA, new subspecies**

PLATE 19, FIGURE 4

This race occupies the series of paredones on the east side of the Rio Santa Cruz and ranges from Mogote Indios to Mogote Colorado to Mogote Bosque. It has the axial threads equaling the spiral on the last whorl and so renders this finely latticed. It is a medium-sized race, varying greatly in coloration, but is always more or less interruptedly spirally banded.

The type, U.S.N.M. no. 468891, comes from the Mogote Bosque, has 4.0 whorls remaining, and measures: Length, 22.5 mm; greater diameter, 15.0 mm; lesser diameter, 11.0 mm.

**CHONDROTHYRETES SHUTTLEWORTHII CATALINENSIS, new subspecies**

PLATE 18, FIGURE 9

This subspecies, which also has the last whorl strongly latticed, was collected about La Catalina, which is several miles to the north of Mogote Bosque. It is a small, pale, thin-shelled race, with the outer peristome conspicuously rayed.

The type, U.S.N.M. no. 468893, a complete specimen, has 6.2 whorls and measures: Length, 19.5 mm; greater diameter, 12.6 mm; lesser diameter, 9.2 mm.

**CHONDROTHYRETES SHUTTLEWORTHII PERPLEXA, new subspecies**

PLATE 18, FIGURE 7

At the Mogote de la Finca, a little southeast of the Sierra la Guira, Henderson and Natenson collected a thin-shelled small race, which has the last whorl latticed, in this way resembling *C. shuttleworthii clivicola* and *C. s. catalinensis*. This is on the west side of the Rio

San Diego and apparently in the range of typical *C. shuttleworthi shuttleworthi*. We say apparently because it is possible that typical *shuttleworthi* may not be occupying exactly the same habitat, but at all events we have here a condition where two subspecies appear to occupy the same range, which is, to say the least, unusual. There is a possibility that when anatomically examined the strongly latticed group may prove a distinct species from *C. shuttleworthi*, in which the last whorl is not latticed. We are not deciding this question here, but merely reporting conditions.

This race is horn-colored with interrupted irregular spots, dots, and blotches of pale brown. The last whorl is a little less swollen than in the two preceding races.

The type, U.S.N.M. no 468895, which comes from the Mogote de la Finca, is a complete specimen, having 7.0 whorls. It measures: Length, 21.0 mm; greater diameter, 13.0 mm; lesser diameter, 9.2 mm.

**CHONDROTHYRETES IMPRESSA, new species**

Shell varying from small to medium sized, thin, pale yellow or flesh-color, marked with interrupted spiral bands of brown on both spire and base. Peristome faintly yellow, unicolor or radiately rayed. Nuclear whorls about 2, inflated, well rounded, smooth except for microscopic granulations and the beginning of the spiral threads on the last part of the last whorl. Postnuclear whorls also inflated and strongly rounded, feebly tufted at the summit, covered by numerous retractorily slanting axial riblets and equally strong spiral threads, which form small nodules at their junction. Periphery and base inflated and strongly rounded with both the axial and spiral sculpture a little more strongly developed in the umbilical region than on the spire. The base is rather widely umbilicate, but the umbilicus is concealed to a varying degree by the strongly reflected outer peristome of the inner lip. Aperture broadly ovate. Peristome double, the outer broadly expanded and reflected, usually of double the width on the inner lip, posterior to the fold, as on the rest of the peristome. The outer peristome is usually radially fluted and concentrically laminated. The inner peristome is somewhat exerted and slightly reflected. Operculum thin, corneous, covered by a rather heavy, somewhat wavy, granular, calcareous deposit.

The animal of *C. impressa hyans* is smoke-gray, a little paler on the sides near the foot, as well as the sole of the foot and tip of the snout. Tentacles dull orange, with the expanded tip a little sooty on the side. There is a pinkish coloration shining through the body of the animal behind the tentacles.

The animal of *C. impressa ornata* is quite uniformly dark smoky gray. Tentacles orange with sooty tips. Sole medially cleft; mo-

tion of the two sides alternate. It suspends itself by a mucous thread when at rest.

The distribution of this species is rather extensive. It appears to range through a considerable area of the mogotes south of the Organ

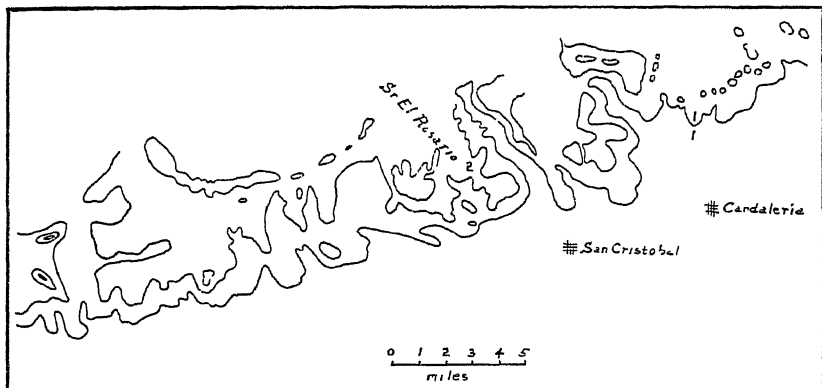


FIGURE 90.—Distribution of subspecies of *Chondrothyretes impressa*: (1) *peregrina*; (2) *rosariensis*.

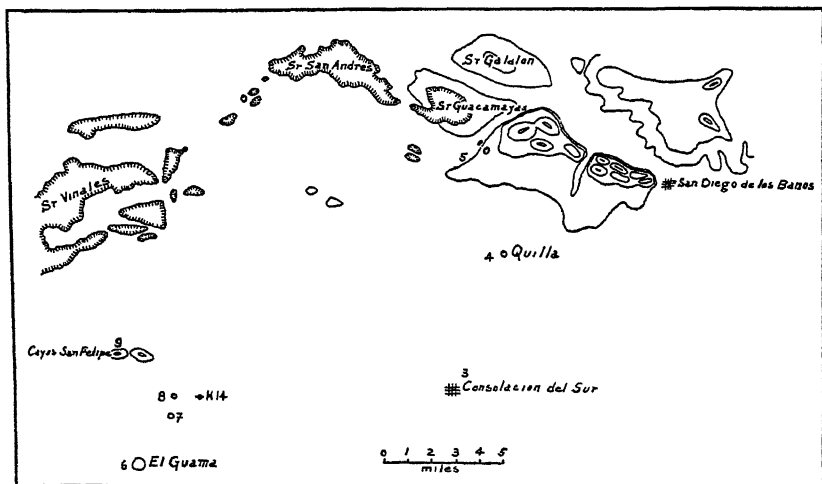


FIGURE 91.—Distribution of subspecies of *Chondrothyretes impressa*: (3) *impressa*; (4) *solacia*; (5) *ornata*; (6) *guamensis*; (7) *hyans*; (8) *gigantea*; (9) *albostoma*.

Mountains but so far has not been reported from the mountains themselves. Its western member is known from El Guama, and its eastern representative comes from Loma de Candelaria.

Distribution of the subspecies of *C. impressa* is shown in figures 90 and 91.

## KEY TO THE SUBSPECIES OF CHONDROTHYRETES IMPRESSA

- Peristome radiatingly rayed with brown.  
 Rays of outer peristome very decided.  
   Greater diameter more than 14 mm.----- *gigantea*  
   Greater diameter less than 13 mm.  
     Spiral color lines confined to posterior two-thirds of  
       whorls between summit and suture----- *ornata*  
     Spiral color lines not confined to posterior two-thirds  
       of whorls between summit and suture.  
       Interrupted spiral lines of brown broad----- *solacia*  
       Interrupted spiral lines of brown not broad----- *impressa*  
 Rays of outer peristome not very decided.  
   Greater diameter more than 15 mm.----- *guamensis*  
   Greater diameter less than 12 mm.  
     Umbilicus with a narrow slit----- *hyans*  
     Umbilicus without a narrow slit----- *peregrina*  
 Peristome not radiatingly rayed----- *albastoma*  
 Shell interruptedly spirally banded.  
 Shell not interruptedly spirally banded----- *rosariensis*

**CHONDROTHYRETES IMPRESSA GIGANTEA**, new subspecies

## PLATE 18, FIGURE 12

This large race comes from a mogote 2 kilometers west of Kilometer 14, between Pinar del Rio and Vinales.

The type, U.S.N.M. no. 468741, a complete specimen, has 6.8 whorls and measures: Length, 24.5 mm; greater diameter, 15.4 mm; lesser diameter, 10.5 mm.

Its large size, combined with the strong radiating rays of the outer peristome, distinguishes it at once from all the other known subspecies.

**CHONDROTHYRETES IMPRESSA ORNATA**, new subspecies

## PLATE 18, FIGURE 2

This subspecies was collected by Natenson on a mogote immediately south of Perez Rivera's house, about one and one-half miles south of the eastern end of the Sierra Guacamayas.

It is a thin-shelled race brightly banded with interrupted dark brown lines, which are confined to the posterior two-thirds of the whorls between summit and suture.

The type, U.S.N.M. no. 468938, has 4.2 whorls remaining and measures: Length, 20.3 mm; greater diameter, 12.5 mm; lesser diameter, 8.4 mm.

**CHONDROTHYRETES IMPRESSA SOLACIA, new subspecies**

## PLATE 18, FIGURE 3

This subspecies was collected by Natenson on Mogote de Quilla, Entronque de Herradura.

It resembles *C. impressa ornata* but has the interrupted brown spiral lines extending over the entire surface of the shell. From *C. impressa impressa* it is distinguished by having the spiral lines of brown much broader.

The type, U.S.N.M. no. 468936, a complete specimen, has 7.5 whorls and measures: Length, 20.0 mm; greater diameter, 11.6 mm; lesser diameter, 8.8 mm.

**CHONDROTHYRETES IMPRESSA IMPRESSA, new subspecies**

## PLATE 18, FIGURE 11

In this race, which comes from the Cantera north of Consolacion del Sur, the shell is small and marked near the summit by one broad and between this and the periphery by 4 narrow interrupted spiral zones of chestnut-brown; another similar zone marks the periphery, while 5 more are present on the base. The outer peristome is fairly strongly rayed. The posterior half of the outer peristome of the inner lip is deeply inbent, plugging the umbilicus, but usually leaving a narrow chink open.

The type, U.S.N.M. no. 468740, a perfect specimen, has 6.9 whorls and measures: Length, 19.3 mm; greater diameter, 11.5 mm; lesser diameter, 8.1 mm.

**CHONDROTHYRETES IMPRESSA GUAMENSIS, new subspecies**

## PLATE 18, FIGURE 10

This large race was collected by Palmer and Riley at El Guama a little west of Pinar del Rio.

Its large size, combined with the faint rays of the outer peristome, easily differentiates it from the other known large *C. impressa gigantea*.

The type, U.S.N.M. no. 169928, has 4.2 whorls remaining, which measure: Length, 23.8 mm; greater diameter, 15.5 mm; lesser diameter, 11.5 mm.

**CHONDROTHYRETES IMPRESSA HYANS, new subspecies**

## PLATE 18, FIGURE 1

In this small race the interrupted spiral color markings consist of irregular blotches that are frequently confluent; especially is this

true on the base. The peristome is only faintly radiately rayed. Here both the axial and spiral threads become somewhat reduced on the last whorl. The reflected outer peristome leaves an open gap at the umbilicus.

This subspecies comes from the mogote southwest of Kilometer 14, between Pinar del Rio and Vinales.

The type, U.S.N.M. no. 492731, is a perfect specimen, having 6.5 whorls, and measures: Length, 19.2 mm; greater diameter, 11.7 mm; lesser diameter, 8.2 mm.

**CHONDROTHYRETES IMPRESSA PEREGRINA, new subspecies**

PLATE 18, FIGURE 4

This small race, which represents the easternmost member of the *impressa* complex, was collected by Arango at Loma de Candelaria, Pinar del Rio Province.

It resembles *C. impressa hyans* in size but has the whorls a little more inflated. It also lacks the narrow umbilical slit.

The type, U.S.N.M. no. 367890, is a complete specimen having 6.4 whorls and measures: Length, 17.8 mm; greater diameter, 11.0 mm; lesser diameter, 8.2 mm.

**CHONDROTHYRETES IMPRESSA ALBOSTOMA, new subspecies**

PLATE 18, FIGURE 6

This race comes from the smaller mogote of the Cayo San Felipe. It has the early whorls regularly interruptedly spirally banded with brown. On the last whorls these markings become broader and more or less axially confluent. The peristome is white. The sculpture of the last whorl is also somewhat less developed than on the preceding turns.

The type, U.S.N.M. no. 468742, is a perfect specimen, having 6.5 whorls and measures: Length, 21.4 mm; greater diameter, 13.5 mm; lesser diameter, 9.3 mm.

**CHONDROTHYRETES IMPRESSA ROSARIENSIS, new subspecies**

PLATE 18, FIGURE 5

This race was collected by Cisnero, at San Cristobal in the Sierra El Rosario. It, like *C. impressa albostoma*, is white-lipped, but differs from that subspecies by lacking the numerous interrupted spiral lines and strong varicial streaks.

The type, U.S.N.M. no. 367887, has 4.0 whorls remaining and measures: Length, 17.3 mm; greater diameter, 11.8 mm; lesser diameter, 8.5 mm.

**CHONDROTHYRETES DELECTABILIS, new species**

Shell small, elongate-ovate, thin, varying in color from uniform flesh-color to pale yellow with or without an axial dark zone behind the peristome and with or without interrupted spiral bands. Nuclear whorls about 2, strongly rounded, smooth, with at least an indication of dark coloration at the suture of the beginning of the turns. Postnuclear whorls well rounded, marked by slender or fairly regular retractorily curved axial riblets and spiral threads, the latter a little stronger than the axial riblets. The junction of these two elements forms slender nodules. Suture well impressed. Periphery strongly

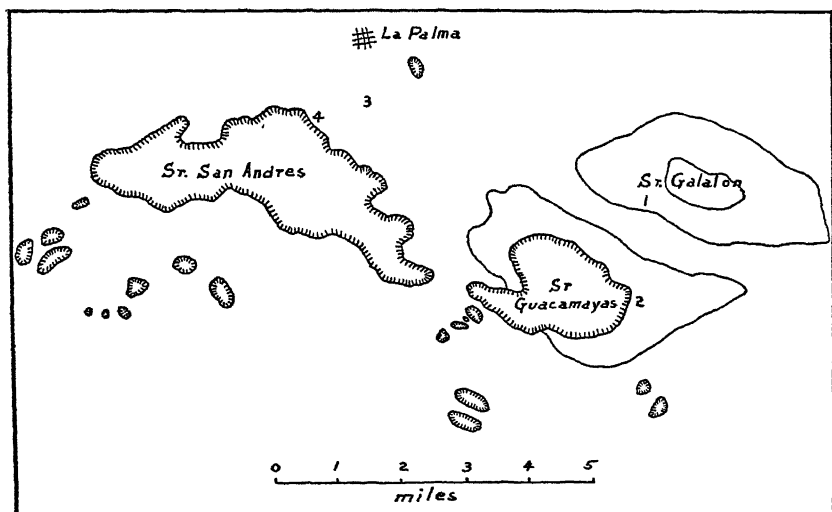


FIGURE 92.—Distribution of the subspecies of *Chondrothyretes delectabilis*: (1) *amabilis*; (2) *delectabilis*; (3) *palmaris*; (4) *bellamaria*.

rounded. Base marked by the same sculpture that characterizes the spire. Aperture broadly ovate; peristome double, the inner slightly exerted; the outer broadly flaringly expanded, somewhat fluted and marked by concentric lamellae with a deep cut on the middle of the inner lip posterior to which the peristome is reflected over the umbilicus, covering this as a broad flap.

The species ranges from the mogotes on the north side of the Sierra San Andrés eastward to the Mogote de Galatón. It breaks up into local races, four of which we are recognizing as subspecies.

Distribution of the subspecies of *Chondrothyretes delectabilis* is shown in figure 92.

## KEY TO THE SUBSPECIES OF CHONDROTHYRETES DELECTABILIS

- Axial dark zone behind peristome present----- *delectabilis*  
 Axial dark zone behind peristome absent.  
     Interrupted spiral bands between summit and suture 5----- *palmaris*  
     Interrupted spiral bands between summit and suture 4.  
         Rays on outer lip fairly strong----- *bellamaria*  
         Rays on outer lip feeble or obsolete----- *amabilis*

## CHONDROTHYRETES DELECTABILIS DELECTABILIS, new subspecies

## PLATE 17, FIGURE 1

This race comes from Caiguanabo, the eastern part of the Sierra Guacamayas.

The type, U.S.N.M. no. 468798, has 3.3 whorls remaining, and measures: Length, 18.4; greater diameter, 11.5 mm; lesser diameter, 8.2 mm.

It is easily distinguished from the other three races by the fact that here the dark axial band behind the peristome is missing. It is also more strongly spirally banded, particularly so on the back of the expanded peristome.

## CHONDROTHYRETES DELECTABILIS PALMARIS, new subspecies

## PLATE 17, FIGURE 5

This race comes from the Mogote de Vegas Nuevas, 3 kilometers from La Palma.

The type, U.S.N.M. no. 468803, is a complete specimen having almost 7.0 whorls and measures: Length, 18.2 mm; greater diameter, 11.2 mm; lesser diameter, 7.9 mm.

It also has the dark axial zone behind the peristome but has five slender spiral interrupted bands between the summit and suture.

## CHONDROTHYRETES DELECTABILIS BELLAMARIA, new subspecies

## PLATE 17, FIGURE 2

This race comes from the Mogote Bella Maria on the north side of Sierra San Andrés near La Palma.

The type, U.S.N.M. no. 468801, has 5.5 whorls remaining and measures: Length, 20.5 mm; greater diameter, 12.0 mm; lesser diameter, 8.9 mm.

Here we have a strong dark axial band behind the peristome, four interrupted slender spiral bands of brown, and rather strong rays on the outside of the outer lip.



**CHONDROTHYRETES DELECTABILIS AMABILIS, new subspecies**

## PLATE 17, FIGURE 4

This race comes from the Mogote de Galalón, east of La Palma.

The type, U.S.N.M. no. 468805, is a complete specimen having 7.0 whorls and measures: Length, 18.7 mm; greater diameter, 11.6 mm; lesser diameter, 7.9 mm.

It has the dark axial zone behind the peristome and four interrupted spiral bands between the summit and suture, but here the rays on the outside of the outer lip are very feeble.

**CHONDROTHYRETES TENEBRATA, new species**

Shell moderately large, ovate, rather stout, varying in ground color from flesh-color and pale yellow to orange to dark brown. The early whorls usually are darker than the later, somewhat unicolor, but usually banded. The peristome varies from white to orange and may or may not be strongly rayed. Nuclear whorls almost 2, the first pale, the next very dark, somewhat inflated and strongly rounded. Post-nuclear whorls inflated; the early ones slightly angulated in the middle and the later ones well rounded and marked by slender, re-tractively curved, axial and spiral threads, the latter of a little wider spacing than the axial. The junction of these two elements on the early whorls forms feeble nodules; on the later turns they scarcely merit that designation. Suture well constricted. The axial riblet extends strongly to the suture and gives to this the merest indication of denticulations. Periphery inflated, well rounded. Base sort, inflated, strongly rounded, and like the spire tending toward a little stronger nodulation at the junction of the axial and spiral elements. Aperture broadly oval. Peristome double, the inner slightly exserted and slightly reflected; the outer broadly flaringly expanded, somewhat fluted and marked by concentric lamellae, cut in the middle of the inner lip, the posterior part to the cut is reflected over the umbilicus which it covers. Operculum thin, corneous, covered with a heavy granular calcareous deposit, which has a somewhat fluted appearance.

The animal of *C. tenebrata albolabris* is smoky gray, a little paler on the foot and the edge of the snout; darkest on the forehead. Tentacles encircled with a flesh-colored ring at their base; the rest scarlet, with the lateral portion of the expanded tip sooty. The internal anatomy shines through behind the tentacles as a pinkish flush. Foot medially cleft; locomotion alternate.

This species ranges through the Sierra San Andrés, some of the mogotes to the south of this and eastward to Guacamayas and the mogotes north and south of this.

It breaks up through this range into a series of subspecies, eight of which we are here characterizing.

Distribution of the subspecies of *Chondrothyretes tenebrata* is shown in figure 93.

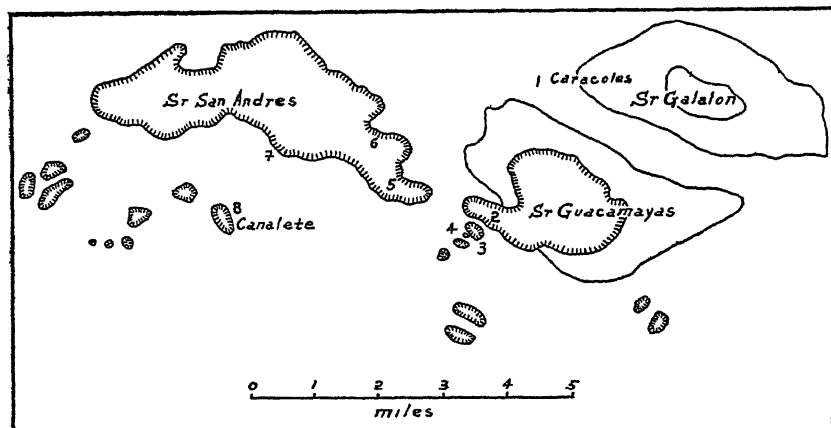


FIGURE 93.—Distribution of the subspecies of *Chondrothyretes tenebrata*: (1) *brevior*; (2) *albolabris*; (3) *variabilis*; (4) *scripta*; (5) *tenebrata*; (6) *montalvensis*; (7) *ayuensis*; (8) *canaletensis*.

#### KEY TO THE SUBSPECIES OF CHONDROTHYRETES TENEBRATA

Expanded lip strongly rayed.

Early whorls dark brown..... *tenebrata*

Early whorls not dark brown.

Shell clouded and marbled

Dark rays of outer lip exceeding in extent the light intervals..... *canaletensis*

Dark rays of outer lip equaling in extent the light intervals..... *scripta*

Dark rays of outer lip less in extent than the light intervals..... *variabilis*

Shell not clouded and marbled

Length of decollated shell more than 23 mm..... *ayuensis*

Length of decollated shell less than 21 mm..... *brevior*

Expanded lip not strongly rayed.

Rays absent or obsolete.

Shell ranging from flesh-color to pale reddish brown..... *albolabris*

Shell ranging from orange to reddish brown..... *montalvensis*

#### CHONDROTHYRETES TENEBRATA TENEBRATA, new subspecies

#### PLATE 19, FIGURE 1

Shell varying from dark orange brown to dark brown, banded to various degrees. The early whorls dark, the later a little paler; the

back of the expanded peristome is conspicuously rayed; the inside of the peristome is pale yellow.

The type, U.S.N.M. no. 468809, comes from the Pasada de las Escaleras, Sierra San Andrés. It has 6.5 whorls, probably having lost the first half of the nuclear turn, and measures: Length, 27.7 mm; greater diameter, 16.2 mm; lesser diameter, 12.4 mm. Additional specimens come from Aserradero, Sierra San Andrés.

This dark-colored race resembles *C. tenebrata montalvensis*, from which it differs by lacking the orange peristome.

CHONDROTHYRETES TENEBRATA CANALETENSIS, new subspecies

PLATE 19, FIGURE 6

This race comes from the Mogotes del Canalete, south of the Sierra San Andrés.

In this race we have a general marbled and clouded pattern; that is, there are axial bands of brown that in reality are the interrupted spiral bands so broadened as to become fused. There is always a pale spiral zone a little posterior to the middle of the base bordered on either side by darker zones. The dark axial band behind the peristome is present, and the back of the expanded peristome is conspicuously rayed, the rays frequently being confluent. The front portion of the peristome, which is pale yellow, is also conspicuously rayed.

The type, U.S.N.M. no. 468818, has 4.5 turns remaining and measures: Length, 23.5 mm; greater diameter, 15.0 mm; lesser diameter, 10.2 mm.

The clouded marbled pattern of this race will readily distinguish it from all others.

CHONDROTHYRETES TENEBRATA SCRIPTA, new subspecies

PLATE 19, FIGURE 2

This race was collected by Natenson on Mogote Largo, the large second mogote off the southwestern end of the Sierra Guacamayas. It resembles *C. tenebrata canaletensis* in general color scheme but the spiral bands, which are interruptedly expanded in axial series, are not axially confluent at these widened intervals. The dark rays of the outer lip equal the light intervals in extent. The shells are also larger than in *C. tenebrata canaletensis*.

The type, U.S.N.M. no. 468982, has 3.8 whorls remaining and measures: Length, 24.3 mm; greater diameter, 16.8 mm; lesser diameter, 12.5 mm.

**CHONDROTHYRETES TENEBRATA VARIABILIS, new subspecies**

## PLATE 20, FIGURE 4

This race was collected by Natenson on the small mogote southwest of the Mogote Largo, which lies off the southwestern end of the Sierra Guacamayas.

In this subspecies the shell averages smaller than those of *C. tenebrata canaletensis*, and is decidedly variable in color, which ranges from dark clouded chestnut-brown through various shades of orange, with brown spiral lines, which may be slender or even confluent at expanded intervals, where they may even form axial dark zones. Regardless of what the general coloration of the shell may be, the radiating dark zones of the outer lip here never equal the lighter intervals in extent.

The type, U.S.N.M. no. 493297, has 4.0 whorls remaining, which measure: Length, 20.8 mm, greater diameter, 14.7 mm; lesser diameter, 10.2 mm.

**CHONDROTHYRETES TENEBRATA AYUENSIS, new subspecies**

## PLATE 20, FIGURE 1

This race comes from the Ensenada de la Ayua on the south side of the Sierra San Andrés.

Shell with the early postnuclear whorls a dark orange, gradually changing to very pale orange or even flesh-color on the last whorl, unicolor or variously banded, strongly rayed on both sides of the expanded outer peristome.

The type, U.S.N.M. no. 468814, has 4.5 whorls remaining and measures: Length, 23.0 mm; greater diameter, 16.0 mm; lesser diameter, 11.3 mm.

The bright orange color of this race readily distinguishes it from all the other subspecies.

**CHONDROTHYRETES TENEBRATA BREVIOR, new subspecies**

## PLATE 20, FIGURE 2

This race comes from Caracoles, north of the Sierra Guacamayas.

Shell small, pale yellow or orange, with the expanded outer lip strongly rayed both in front and on the back. The dark axial zone behind the peristome is narrow, or almost absent. The shell is feebly rayed.

The type, U.S.N.M. no. 468807, is a complete specimen having 6.7 turns and measuring: Length, 20.8 mm; greater diameter, 14.5 mm; lesser diameter, 9.4 mm.

The small size will readily distinguish this race from all the others.

## CHONDROTHYRETES TENEBRATA ALBOLABRIS, new subspecies

## PLATE 20, FIGURE 3

This race comes from the Sierra Guacamayas.

This subspecies has the shell orange or pale brownish orange; it has the dark band behind the peristome, which is white or almost so. The expanded outer peristome is obsoletely rayed on the front side and a little more strongly on the back.

The type, U.S.N.M. no. 468816, has 5.0 whorls remaining and measures: Length, 24.0 mm; greater diameter, 15.8 mm; lesser diameter, 10.8 mm.

This race approximates *C. tenebrata ayuensis* but is a little darker in coloration and lacks the conspicuous raying of the peristome and is also smaller.

## CHONDROTHYRETES TENEBRATA MONTALVENSIS, new subspecies

## PLATE 19, FIGURE 3

This race comes from the Coral de El Montalvo, on the road to La Palma from the Sierra San Andrés.

Shell dark orange or blackish brown with the peristome orange, unicolor or banded, with or without a dark band at the summit. The dark axial band is present behind the peristome, which is but slightly rayed on the back. The front of the expanded peristome is obsoletely rayed, or if rays are present they are inconspicuous.

The type, U.S.N.M. no. 468856, has 6.0 whorls remaining and measures: Length, 26.0 mm; greater diameter, 16.3 mm; lesser diameter, 11.3 mm.

This race in general appearance approximates most nearly typical *C. tenebrata tenebrata* but can at once be distinguished from that by having the expanded peristome orange instead of pale yellow.

## CHONDROTHYRETES RETICULATA, new species

Shell conic, turreted, exceedingly variable in coloration, even within the same subspecies. The shell may be pure alabaster white, pale strawcolor, yellow, orange, red, buff, brown, or even sooty brown; unicolor or banded with continuous spiral lines or zones of darker color than the ground color, or the spiral bands may be interrupted and the elements composing them may be arranged in axial series, the shell thereby appearing varicially streaked. There is usually a narrow white line at the summit. In some of the subspecies there is a dark axial zone immediately preceding the expanded peristome, which is usually white or may be faintly yellow. The raying of the outer peristome is not marked in this species, only some of the

subspecies have this tendency. Nuclear whorls about 2, well rounded, smooth, the last portion of the last turn showing the beginning of the postnuclear sculpture. The postnuclear whorls are inflated, well rounded, appressed at the summit, which is feebly denticulated and marked by numerous, closely spaced, axial riblets and spiral threads equaling the riblets in strength. This combination gives to the surface the reticulated pattern responsible for this subspecific name. Aperture broadly ovate. Peristome double; the inner somewhat exserted and slightly reflected; the outer broadly flaringly expanded, somewhat fluted, and marked by feeble concentric lamellae. The outer peristome is cut in the middle of the inner lip, and the portion posterior to the cut is reflected over the umbilicus as a heavy callus, which also extends over the parietal wall. The breathing pore is a conspicuous perforation on the parietal wall about as far removed from the edge of the inner lip as it is from the posterior angle. The operculum is thin, paucispiral, with submarginal nucleus covered on the outside with a thin deposit of fine calcareous granules which are arranged in a somewhat radiating pattern.

The animal of *C. reticulata encinarensis* is flesh-color, with ashy suffusions. Tentacles orange, tipped with brown at the slightly expanded end; white at base. Feelers paler at edge. Foot deeply medially cleft, flesh-color. Motion of the two sides alternate.

The animal of *C. reticulata reticulella* is ashy gray with the forehead at the base of the tentacles white. The space between the tentacles is marked by numerous very fine dark dots. Tentacles orange-red, tipped with buff. Sole of foot short, light ash gray, medially cleft. Motion alternate on the two sides.

This subspecies ranges through the central part of the Organ Mountains of Pinar del Rio Province, that is, from Hoyo San Antonio through La Mina west of Pan de Azucar and south to the Kilometer 14 region between Vinales and Pinar del Rio, embracing not only the main blocks of limestone, but also the isolated lumps of the Laguna Piedras region and the blocks southwest of Vinales.

As in the case of the other widely distributed species, this complex breaks up into a series of zoogeographic races, each more or less sharply delimited in its distribution. Thirteen of these we are here designating as subspecies.

Distribution of the subspecies of *C. reticulata* is shown in figure 94.

#### KEY TO THE SUBSPECIES OF CHONDROTHYRETES RETICULATA

Shell large, length more than 25 mm.

Dark spiral band at summit present.

Axial and spiral threads fine	encinarensis
Axial and spiral threads less fine	costanarensis

- Dark spiral bands at summit absent.  
 White line at summit obsolete.  
   Shell large, 27.8 mm----- *costanerensis*  
   Shell medium sized, 25.2 mm----- *galerensis*  
 White line at summit not obsolete.  
   Whorls strongly inflated.  
     Shell clouded----- *petricola*  
     Shell not clouded----- *fraterna*  
   Whorls not strongly inflated.  
     Shell strongly denticulated at summit----- *reticulata*  
     Shell not strongly denticulated at summit----- *versicolor*  
 Shell not large, length less than 22 mm.  
 Front of outer peristome rayed----- *saccharinella*  
 Front of outer peristome not rayed.  
   Rear of outer peristome feebly rayed.  
     Shell dark sooty brown----- *reticulella*  
     Shell not dark sooty brown.  
       Body of uniform flesh-color----- *pellucida*  
       Body not of uniform flesh-color.  
         Last whorl banded.  
           Shell reddish brown----- *scrobicula*  
           Shell variously colored----- *petricolella*  
         Rear of outer peristome not feebly rayed----- *fratercula*

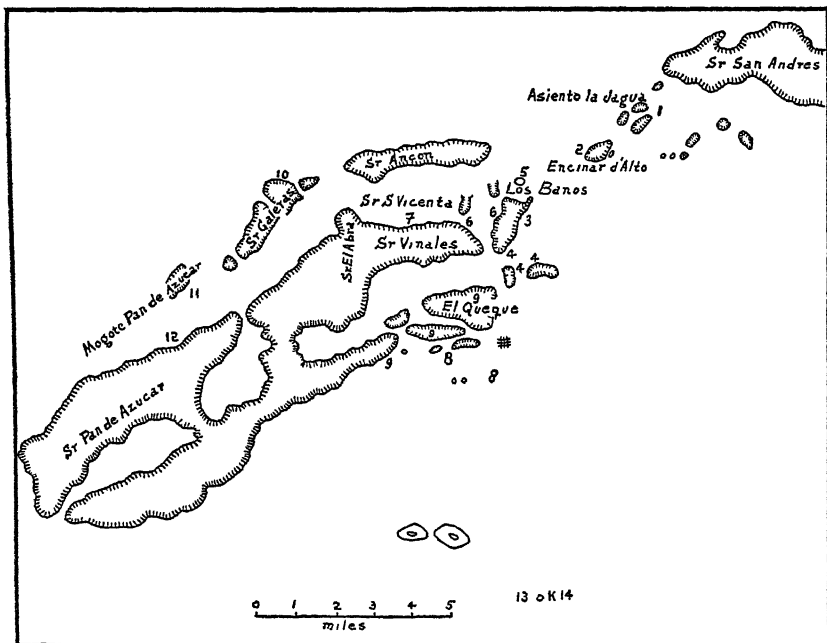


FIGURE 94.—Distribution of the subspecies of *Chondrothyretes reticulata*: (1) *scrobicula*; (2) *encinarenensis*; (3) *petricolella*; (4) *petricola*; (5) *reticulella*; (6) *reticulata*; (7) *costanerensis*; (8) *fraterna*; (9) *galerensis*; (10) *galerensis*; (11) *saccharinella*; (12) *versicolor*; (13) *pellucida*.

**CHONDROTHYRETES RETICULATA ENCINARENSIS, new subspecies**

## PLATE 21, FIGURE 2

This race is confined to the mogote known as La Mina or Encinar de Alto. It is the easternmost of the larger races. It is light in color, ranging from flesh-color to pale orange, never banded, except for the moderately broad zone immediately below the white line at the summit. This dark band, combined with the absence of other bandings, readily distinguishes this from all the other races, except an occasional specimen of *C. r. costanerensis*.

The type, U.S.N.M. no. 468984, a complete specimen, has 7.0 whorls and measures: Length, 26.0 mm; greater diameter, 16.7 mm; lesser diameter, 11.3 mm.

**CHONDROTHYRETES RETICULATA COSTANERENSIS, new subspecies**

## PLATE 21, FIGURE 8

This race occupies the Costanera San Vicente and the Costanera del Abra. Here again we have an enormous range of color variation, which extends from white to straw-color, to yellow, to orange, to brown; the shell may be mottled, banded, or flecked, unicolor or interruptedly banded. We find here also an extension of the La Mina features, namely, a dark spiral band immediately below the white line at the summit. This, however, is not constant but appears to be present in about one-third of the shells. A dark varicial line behind the peristome is present in most specimens. The expanded peristome itself is not rayed, or bears the merest indication of rays at its base on the outside. Specimens from Hoyo de Magdalena are redder than those of other parts of the range of this subspecies.

The type, U.S.N.M. no. 468900, comes from Costanera San Vicente. This is a complete specimen having 6.3 whorls and measures: Length, 27.8 mm; greater diameter, 17.7 mm; lesser diameter, 12.6 mm.

**CHONDROTHYRETES RETICULATA GALERENSIS, new subspecies**

## PLATE 20, FIGURE 10

In this race, which occupies the western end of the Sierra Galera, the shells are of medium size and thin, and they vary from pale orange to brown. The usual white line at the summit is scarcely indicated, and the peristome is free of rays, except for mere indications.

The type, U.S.N.M. no. 492895, has 4.3 whorls remaining and measures: Length, 25.2 mm; greater diameter, 15.9 mm; lesser diameter, 12.2 mm.



**CHONDROTHYRETES RETICULATA PETRICOLA, new subspecies****PLATE 20, FIGURE 9**

This subspecies ranges through the Sierra Chorrera and the Mogotes Marmol of the Laguna Piedras. The race is characterized by its thin shell, tawny ground color, and the fine interrupted spiral lines, which are arranged in axial series, thus giving to the shell a decidedly clouded effect. The area immediately behind the peristome forms a dark axial zone.

The type, U.S.N.M. no. 468906, a complete specimen from the Sierra Chorrera, has 7.1 whorls remaining and measures: Length, 28.9 mm; greater diameter, 17.2 mm; lesser diameter, 13.3 mm.

**CHONDROTHYRETES RETICULATA FRATERNA, new subspecies****PLATE 20, FIGURE 11**

This race, which comes from El Cuajani, Mogotes dos Hermanos, El Queque, is large and thin shelled and varies in color from white through orange and reddish to brown. It is not clouded. There is a slender, white, finely denticulated line at the summit not bordered with a dark line. The outer peristome is free of rays on both sides.

The type, U.S.N.M. no. 492885, comes from El Queque. It has 7.0 whorls and measures: Length, 28.6 mm; greater diameter, 17.5 mm; lesser diameter, 13.2 mm.

**CHONDROTHYRETES RETICULATA RETICULATA, new subspecies****PLATE 21, FIGURE 6**

The typical race ranges through the limestone bluffs of Banos San Vicente, the Ensenada de los Banos, and the Puerta de la Ancon. This race is also very variable in color but dark as compared with the other large races, brown being the prevailing coloration. The finely denticulated white line at the summit is very marked in this race, and interrupted spiral bands are fairly regularly arranged in axial series, giving this a more or less varicially streaked effect. The peristome is not rayed.

The type, U.S.N.M. no. 492910, comes from Banos San Vicente. It has 6.0 whorls remaining and measures: Length, 27.5 mm; greater diameter, 16.4 mm; lesser diameter, 12.6 mm.

**CHONDROTHYRETES RETICULATA VERSICOLOR, new subspecies****PLATE 21, FIGURE 4**

This subspecies occupies the north slope of Pan de Azucar. It is a dark race, frequently with a light base and a broad median spiral band. The whorls are not as strongly inflated as in some of the

other races and a white line at the summit is indicated. The summit of the whorls is not strongly denticulated. The front and back of the expanded peristome are not rayed.

The type, U.S.N.M. no. 492877, comes from the western end of Pan de Azucar. It is a complete specimen having 6.8 whorls and measuring: Length, 27.8 mm; greater diameter, 16.7 mm; lesser diameter, 12.7 mm.

**CHONDROTHYRETES RETICULATA SACCHARINELLA, new subspecies**

**PLATE 21, FIGURE 1**

This subspecies comes from Mogote Pan de Azucar, that conspicuous block of limestone lying a couple of miles north of the Sierra de Chichones. This is a diminutive race, very similar to *C. reticulata versicolor*, which has the peristome both on the front and back conspicuously rayed. It also has a denticulated white line at the summit.

The type, U.S.N.M. no. 492884, has 4.8 whorls remaining and measures: Length, 21.0 mm; greater diameter, 13.8 mm; lesser diameter, 10.7 mm.

**CHONDROTHYRETES RETICULATA RETICULELLA, new subspecies**

**PLATE 20, FIGURE 7**

This diminutive race is confined to a small mogote on Martinez's place at Banos San Vicente, which stands at some distance from the main range. It is a very dark chestnut-brown race, with a conspicuous denticulated zone of white at the summit. The peristome and parietal callus are also white without rays.

The type, U.S.N.M. no. 474197, is a complete specimen having 6.3 whorls and measuring: Length, 18.0 mm; greater diameter, 11.6 mm; lesser diameter, 8.6 mm.

Very dark forms of *C. reticulata petricolella* resemble this in coloration, but they are a little more finely sculptured and never so dark.

**CHONDROTHYRETES RETICULATA PELLUCIDA, new subspecies**

**PLATE 20, FIGURE 6**

This small race was taken on the second mogote on the right side of Kilometer 14 on the road between Pinar del Rio and Vinales. It is pale yellow, with white denticulations at the summit and white peristome. In some specimens faint brown spiral lines are indicated, and some individuals also show an axial dark band behind the peristome.

The type, U.S.N.M. no. 468916, is a complete specimen having 6.5 whorls. It measures: Length, 21.4 mm; greater diameter, 13.3 mm; lesser diameter, 10.0 mm.

**CHONDROTHYRETES RETICULATA SCROBICULA, new subspecies**

**PLATE 21, FIGURE 3**

This race comes from a small mogote known as Hoyos de San Antonio Asiento de la Jagua. It is a small race, orange in color, with white denticulations at the summit and the spaces between these brown. The peristome is slightly rayed on the back. There is also a feeble dark axial zone behind the peristome.

The type, U.S.N.M. no. 468914, has 5.0 whorls remaining and measures: Length, 20.4 mm; greater diameter, 12.8 mm; lesser diameter, 10.2 mm.

**CHONDROTHYRETES RETICULATA PETRICOLELLA, new subspecies**

**PLATE 20, FIGURE 5**

Under this name we shall combine the small shells occupying the Mogotes Piedra Laguna, as well as those that border the road from Vinales to the Puerta del Ancon. In the main this race resembles *C. r. petricola*, but it is very variable in color, ranging in ground color from flesh-color to pale brown, with the base frequently banded and the rest of the shell marked by fine spiral lines, which are also frequently arranged in axial series.

The type, U.S.N.M. no. 468908, comes from Fogon de los Negros from the northern part of the Laguna Piedras. It is a complete specimen having 7.0 whorls and measuring: Length, 20.2 mm; greater diameter, 12.4 mm; lesser diameter, 8.7 mm.

**CHONDROTHYRETES RETICULATA FRATERCULA, new subspecies**

**PLATE 20, FIGURE 8**

This race occupies the small mogotes between Vinales and the dos Hermanos, etc., including Mogote Vigil and Mogote la Feita.

The shells vary from pale chestnut-brown to sooty brown, with the peristome white on both sides. The dark forms seem conspicuously marked by the slender denticulated white line at the summit.

The type, U.S.N.M. no. 492893, comes from the Mogote la Feita. It has 3.6 whorls remaining and measures: Length, 17.6 mm; greater diameter, 12.8 mm; lesser diameter, 9.1 mm.

## CHONDROTHYRETES INCRASSATA (Wright) Pfeiffer

Shell elongate-ovate, varying in color from flesh-color through straw-color to pale orange and even pale brown in some individuals; the last whorl is always paler than the rest; the shell may have axial varicial streaks of a little darker coloration than the ground color. In two of the known races there is an orange blotch behind the peristome. Peristome white. Nuclear whorls almost 2, forming a somewhat truncated apex, strongly rounded, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by slender, retractively slanting, axial riblets, which are stronger on the early turns than those succeeding them, becoming decidedly enfeebled on the last whorl. The spiral sculpture consists of slender threads a little stronger than the axial. The intersection of the axial riblets and spiral threads form slender nodules on the early turns, while the spaces enclosed between them are rectangular pits. On the last whorl, however, the nodules are absent and the pits reduced to fine malleations. Suture well constricted. Periphery of the last whorl inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuations of the axial riblets and spiral threads. The spiral threads and axial riblets are a little stronger near the umbilicus than on the posterior half of the base, forming here weak nodules at their junction. Aperture broadly oval; peristome double; the inner heavy and broadly expanded, covering two-thirds of the outer. The outer is expanded and reflected, forming a sinus at the posterior angle, the part that projects beyond the inner slightly fluted at the edge and marked by concentric lines of growth; posterior to the notch of the inner lip, the outer peristome is reflected as a broad white callus over the umbilicus, which it completely covers, extending a little less broadly upon the parietal wall, where it is appressed to the preceding turn. The breathing pore is conspicuous on the parietal wall about as far removed from the edge of the outer lip as it is from the posterior angle. Operculum thin, paucispiral, with almost submarginal nucleus, covered on the outside with a thin deposit of fine calcareous granules, which form a somewhat radiating pattern.

Gundlach<sup>4</sup> says of the animal of *incrassata*: "Animal grey, eye ring and edge of operculum whitish. Antennae beautifully coral colored, trending toward saffron-yellow. On the sides of the foot are spots which are composed of elevated white dots."

*Chondrothyretes incrassata* is distinguished from *C. reticulata* by its much less strongly reticulated sculpture and from *C. cerina* by

<sup>4</sup> Malakozool. Blätter, vol. 10, p. 183, 1862.

having this sculpture stronger and especially by having the inner peristome much expanded and thickened and the outer separated from

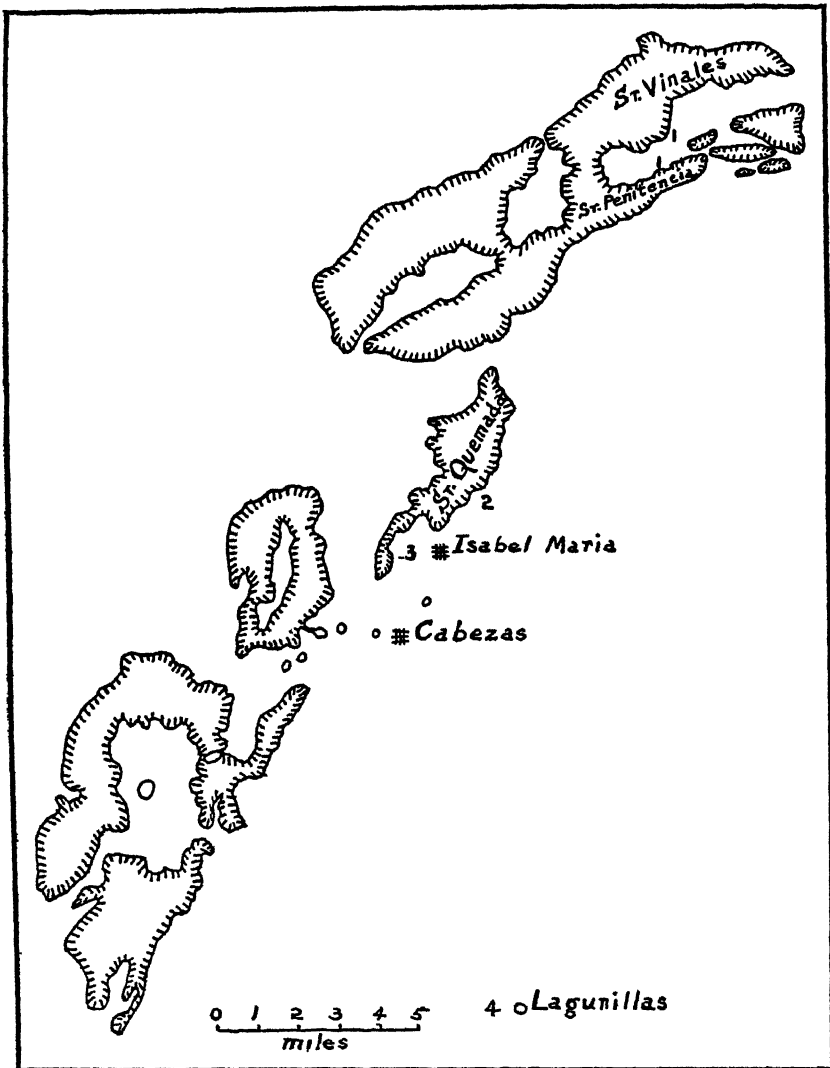


FIGURE 95.—Distribution of the subspecies of *Chondrothyretes incrassata*: (1) *incrassata*; (2) *subincrassata*; (3) *aurantiaca*; (4) *fumata*.

the parietal callus by an inbent channel at the posterior angle, causing the outer peristome to project at a point.

Distribution of the subspecies of *C. incrassata* is shown in figure 95.

## KEY TO THE SUBSPECIES OF CHONDROTHYRETES INCRASSATA

Orange blotch behind peristome present.

Length of shell more than 25 mm..... *aurantiaca*

Length of shell less than 22 mm..... *fumata*

Orange blotch behind peristome absent.

Sculpture feeble..... *incrassata*

Sculpture not feeble..... *subincrassata*

## CHONDROTHYRETES INCRASSATA AURANTIACA, new subspecies

## PLATE 22, FIGURE 5

The mogotes between Cabezas and Isabel Maria and the Sierra Quemada harbor a race that about equals *C. incrassata incrassata* in size and sculpture. The shells, however, are marked with a conspicuous orange blotch behind the peristome. To this race we have given the above name.

The type, U.S.N.M. no. 367872, which comes from Mogote Isabel Maria, is an almost perfect specimen. It has 6.0 whorls and measures: Length, 27.2 mm; greater diameter, 17.8 mm; lesser diameter, 13.8 mm.

## CHONDROTHYRETES INCRASSATA FUMATA, new subspecies

## PLATE 22, FIGURE 8

This diminutive race resembles *C. incrassata aurantiaca*, from which its small size at once distinguishes it. It comes from Lagunillas, which lies halfway between the range *C. incrassata aurantiaca* and the south coast.

The type, U.S.N.M. no. 468800, has 5.4 whorls remaining and measures: Length, 21.3 mm; greater diameter, 12.7 mm; lesser diameter, 9.4 mm.

## CHONDROTHYRETES INCRASSATA INCRASSATA (Wright) Pfeiffer

## PLATE 22, FIGURE 7

1862. *Chondropoma incrassatum* (WRIGHT) PFEIFFER, Malakozool. Blatter, vol. 10, pp. 182-183.

This subspecies occupies the Sierra Vinales and part of the Sierra Penitencia and is distinguished from *C. incrassata subincrassata*, the race south of it, by having a little heavier shell, paler coloration, and feebler sculpture, and by being less frequently marked by spiral color lines.

The specimen figured, one of a series of topotypes, U.S.N.M. no. 468944, was collected by Wright at Vinales. It is a perfect specimen having 6.8 whorls and measuring: Length, 29.3 mm; greater diameter, 19.5 mm; lesser diameter, 14.6 mm.

## CHONDROTHYRETES INCRASSATA SUBINCRASSATA, new subspecies

## PLATE 22, FIGURE 9

This race we have from the Sierra Quemada south of the range of the typical *C. incrassata incrassata*, and from the Mogote Caoba near this. It has the shell thinner and considerably more strongly sculptured than the typical form.

The type, U.S.N.M. no. 468945, comes from the Sierra Quemada. It has 5.5 whorls remaining and measures: Length, 30.3 mm; greater diameter, 19.4 mm; lesser diameter, 14.4 mm.

## CHONDROTHYRETES CERINA, new species

Shell broadly ovate, wax yellow, sometimes pale orange or chestnut-brown, or even purplish, unicolor, or marked with axial streaks of a darker shade. Nuclear whorls 2, the first smooth, the second showing the beginning of the postnuclear sculpture at its termination. Postnuclear whorls inflated, strongly rounded, marked on the early turns by retractively slanting axial riblets and spiral threads of almost the same strength; on the later turns these become less conspicuous and in one of the races quite obsolete on the last whorl. The base is short, strongly rounded, and sculptured like the posterior portion of the last turn. Aperture broadly ovate; peristome double, the inner reflected over the outer and adnate to it; the outer is moderately, strongly expanded and considerably thickened; the inner lip is reflected over anterior to the cut, and covers the umbilicus. It is not distinctly angulated as in some of the other species; on the parietal wall it extends over the preceding turn. The outer peristome does not project as a conspicuous auricle at the posterior angle. Breathing pore on the parietal wall a little anterior to the posterior angle of the aperture and a little within the peristome. Operculum with almost submarginal nucleus and a considerably thickened calcareous deposit on the last turn.

This species occupies the region between Vinales and the Sierra del Infierno, extending southwest to Santo Tomas, Hoyo del Guama, and to the Ensenada Pan de Azucar, and across the Sierra Martillo, breaking up into a number of subspecies, which are here described.

The shells of this species can readily be distinguished from its nearest relative, *C. incrassata* (Wright), by having the auricle at the posterior angle of the aperture almost absent and by having the outer peristome of the inner lip anterior to the notch not expanded, but forming an almost straight thickened columella, while in *incrassata* it always projects as a sharp element. *C. incrassata* also has the inner peristome much more thickened and much broader.

The animal of *C. cerina subcerina* is short, ashy gray, with the head adjoining the tentacles, a little paler, which is also the case at





## CHONDROTHYRETES CERINA POLITA, new subspecies

## PLATE 23, FIGURE 2

This race comes from the Sierra Martillo. It resembles typical *C. cerina cerina* but has the sculpture of the last whorl reduced to obsolescence.

The type, U.S.N.M. no. 468598, comes from Sitio del Martillo. It has 4.5 whorls remaining and measures: Length, 23.8 mm; greater diameter, 15.5 mm; lesser diameter, 13.2 mm.

## CHONDROTHYRETES CERINA ROSEOAPICATA, new subspecies

## PLATE 23, FIGURE 9

In the high parts of the Sierra del Infierno and the Sierra Penitencia we have a race with decidedly rosy tip. Here the dark, almost sooty-brown, color of the rest of the shell prevails, the lighter phase being less numerous. This, combined with the white peristome, renders this race very beautiful.

The type, U.S.N.M. no. 468960, comes from the high parts of the Sierra del Infierno. It has 5.4 whorls remaining and measures: Length, 31.6 mm; greater diameter, 18.9 mm; lesser diameter, 16.3 mm.

## CHONDROTHYRETES CERINA PUELLA, new subspecies

## PLATE 23, FIGURE 5

This subspecies is quite isolated from the main group and, as in certain other forms occupying small offlying lumps of limestone, we have here a diminutive race whose size at once distinguishes it from the other members of the species. It comes from the Hoyo del Guama, southeast of Santo Tomas.

The type, U.S.N.M. no. 468964, a complete specimen, has 6.4 whorls and measures: Length, 19.5 mm; greater diameter, 12.8 mm; lesser diameter, 10.7 mm.

## CHONDROTHYRETES CERINA CERINA, new subspecies

## PLATE 23, FIGURE 10

This subspecies ranges through the lower reaches of the Sierra del Infierno and the adjacent mogotes.

It is quite variable in size, ranging from 24 to 30 mm in length. In color it also ranges through everything except the roseoapicate form. In sculpture it stands midway between *C. cerina polita*, which has the last whorl obsoletely marked, and *C. cerina subcerina*, which is most strongly sculptured.

The type, U.S.N.M. no. 367874, a large complete individual from Sitio del Infierno, Sierrro del Infierno, has 5.5 whorls and measures:

Length, 27.2 mm; greater diameter, 17.0 mm; lesser diameter, 14.8 mm.

CHONDROTHYRETES CERINA SUBCERINA, new subspecies

PLATE 23, FIGURE 8

This race extends through the Ensenada Pan de Azucar, the large embayment in the western end of the Organ Mountains. It is the most strongly sculptured subspecies known, recalling weakly marked *C. reticulata*, but at once distinguished from this by the character of the peristome.

The type, U.S.N.M. no. 367875, has 4.5 whorls remaining and measures: Length, 27.0 mm; greater diameter, 16.9 mm; lesser diameter, 14.0 mm.

CHONDROTHYRETES BARBOURI, new species

Shell large and stout, varying in color from flesh-color through yellow and orange to brown; unicolor or marked with spiral lines of brown; peristome white, sometimes partly rayed on the back. Nuclear whorls about 2, well rounded, marked only by incremental lines. Postnuclear whorls somewhat inflated, well rounded, marked by rather distantly spaced spiral threads and on the early postnuclear whorls by axial threads of almost the same strength, which rapidly decrease in strength and become obsolete as the shell increases its whorls. Suture well impressed, not denticulated. Aperture broadly ovate, slightly angulated at the posterior angle; peristome double, the inner, which is slightly exerted, extends a little above the broadly expanded, somewhat radially fluted and concentrically feebly laminated outer, which has the inner lip cut in the middle and the posterior half reflected over the umbilicus, which it completely covers.

The species ranges through the Organ Mountains about Luis Lazo and eastward through Sumidero to Cabezas and some of the mogotes adjacent to this.

KEY TO THE SUBSPECIES OF CHONDROTHYRETES BARBOURI

Shell predominantly brown.....	barboursi
Shell predominantly pale.....	itineraria

CHONDROTHYRETES BARBOURI BARBOURI, new subspecies

PLATE 21, FIGURE 5

This is the large brown race that occupies the high mountains of the Sierra San Carlos and the Sierra Acostas all around Luis Lazo and northeastward through the Sierra Sumidero.

*C. barboursi barboursi* is distinguished from the other subspecies by being larger and heavier and in having the brown color predomi-

nant. Spiral color bands here are also less frequently met with than in *C. barbouri itineraria*.

The type, U.S.N.M. no. 474199, comes from Luis Lazo and has 5.5 whorls remaining, which measure: Length, 34.2 mm; greater diameter, 21.5 mm; lesser diameter, 16.2 mm.

**CHONDROTHYRETES BARBOURI ITINERARIA, new subspecies**

**PLATE 21, FIGURE 7**

This subspecies extends through the mogotes along the roadside to the east and west of Cabezas. It is smaller, thinner, paler, and almost always spirally banded.

The type, U.S.N.M. no. 499589, comes from the first mogote on the northwest side of the road east of Cabezas. It has 5.8 whorls remaining and measures: Length, 28.0 mm; greater diameter, 16.4 mm; lesser diameter, 12.5 mm.

**CHONDROTHYRETES GUNDLACHI (Arango)**

Shell rather large, ovate-conic, varying in ground color from flesh-color through buff to pale orange, with or without a darker zone behind the peristome and with or without interrupted spiral bands. Nuclear whorls about 1.5, inflated, well rounded, smooth except for incremental lines. Postnuclear whorls well rounded, marked by slender, retractively curved, axial threads and rather stronger spiral threads, the combination of which forms a somewhat fenestrated pattern, while the junction of these elements forms slender nodules. The spiral threads frequently are conspicuously white in the typical race. Suture well constricted. Periphery of the last whorl inflated, well rounded. Base short, well rounded, and marked like the spire. Aperture broadly ovate. Peristome double; the inner slightly exserted and somewhat reflected, the outer broadly flaringly expanded, fluted and marked with concentric lamellae, cut on the middle of the inner lip with the posterior part reflected as a broad callus, which closes the umbilicus. The parietal wall is covered with a broadly expanded outer peristome. The breathing pore is on the parietal wall near the posterior angle of the aperture. Operculum with 3.5 whorls, the last covered with a heavy deposit of calcareous granules, which have a somewhat fluted appearance.

This species ranges from the Sierra de Paso Real Guane eastward through the Sierra de Guane through Portales through the Puerta de la Murallia.

We are recognizing five zoogeographic races, which we are designating as subspecies.

Distribution of the subspecies of *C. gundlachi* is shown in figure 97.

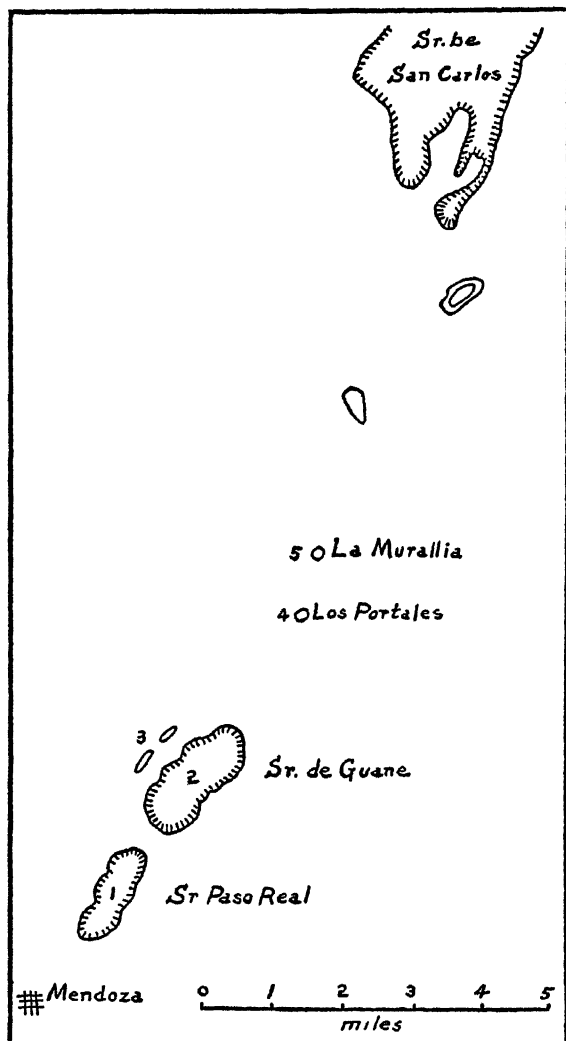


FIGURE 97.—Distribution of the subspecies of *Chondrothyretes gundlachi*: (1) *gundlachi*; (2) *guanensis*; (3) *deviata*; (4) *porticola*; (5) *murallensis*.

KEY TO THE SUBSPECIES OF *CHONDROTHYRETES GUNDLACHI*

Ground color of shell red or reddish.

Spiral threads conspicuously white..... *gundlachi*

Spiral threads not conspicuously white..... *guanensis*

Ground color of shell not red or reddish.

Ground color of shell yellowish or white.

Shell strongly spirally banded.

Shell mottled and clouded..... *porticola*

Shell not mottled and clouded..... *murallensis*

Shell feebly or not spirally banded..... *deviata*

## CHONDROTHYRETES GUNDLACHI GUNDLACHI (Arango)

## PLATE 22, FIGURE 6

1862. *Cyclostoma* (*Chondropoma*) *gundlachi* ARANGO, JOURN. CONCHYL., vol. 10, pp. 408-409.

This subspecies occupies the Sierra de Paso Real.

The specimen figured, U.S.N.M. no. 492947, is a complete specimen having 7.0 whorls and measures: Length, 23.5 mm; greater diameter, 15.8 mm; lesser diameter, 11.0 mm.

It is easily distinguished from all the other races by the fact that the spiral threads are white, while the rest of the shell is dark in color.

## CHONDROTHYRETES GUNDLACHI GUANENSIS, new subspecies

## PLATE 22, FIGURE 3

In this race, which comes from the Sierra de Guane, the spiral threads are slightly darker than the rest of the shell, and the peristome is white. This, however, does not give to the surface of the shell a conspicuously banded appearance.

The type, U.S.N.M. no. 492948, has 3.5 whorls remaining and measures: Length, 26.5 mm; greater diameter, 18.8 mm; lesser diameter, 13.3 mm.

## CHONDROTHYRETES GUNDLACHI PORTICOLA, new subspecies

## PLATE 22, FIGURE 1

In this race, which comes from Portales, the shell is marked by conspicuous, interrupted, rather broad spiral bands, which give it a mottled and marbled aspect. The outer peristome is decidedly rayed.

The type, U.S.N.M. no. 492949, is a complete specimen having 6.4 whorls and measures: Length, 24.5 mm; greater diameter, 16.0 mm; lesser diameter, 11.6 mm.

These characters conspicuously differentiate this race from all the others.

## CHONDROTHYRETES GUNDLACHI MURALLENSIS, new subspecies

## PLATE 22, FIGURE 2

This race, from the the Puerta de la Murallia, also has interrupted spiral bands, as in *C. gundlachi porticola*, but they are less pronounced, and the color scheme does not tend toward mottling or marbling, as in the other subspecies. The expanded outer lip is also less conspicuously rayed.

The type, U.S.N.M. no. 367880, has 4.8 whorls remaining and measures: Length, 27.0 mm; greater diameter, 16.6 mm; lesser diameter, 12.1 mm.

**CHONDROTHYRETES GUNDLACHI DEVIATA, new subspecies**

**PLATE 22, FIGURE 4**

In the caves of the mogotes on the south side of the road leading from Luis Lazo to Guane, and separated from the Sierra de Guane by the Rio Portales, Bartsch collected a lot of shells that have finer sculpture than the other races and that may have the spiral threads brown. These vary from white to yellow, unicolor or spirally feebly banded. The peristome is white, at times weakly rayed.

The type, U.S.N.M. no. 387907, collected as above stated, is a complete specimen, having 6.5 whorls and measuring: Length, 25.6 mm; greater diameter, 16.7 mm; lesser diameter, 12.6 mm.

**CHONDROTHYRETES AFFINIS, new species**

**PLATE 21, FIGURE 9**

1863. *Chondropoma gundlachi* PFEIFFER, Malakozool. Blätter, vol. 10, p. 182 (in part).

Shell large, thin, ovate-turreted. The early whorls are dark brown, paling gradually anteriorly to buff on the last turn. Peristome white. At more or less regular intervals there are white or light axial zones, and the spiral threads are also light, so that the combination of these two light elements against the dark background lends to the shell a very peculiar fenestrated pattern. Nuclear whorls 2, strongly rounded, smooth. Postnuclear whorls inflated, strongly rounded, and marked by numerous, hairlike, decidedly retractively slanting, axial threads. The spiral sculpture consists of alternating stronger and heavier threads; the lighter threads are about equal to the axial and the heavier are at least twice the size of the lesser. The latter are rendered beautifully beaded by the axial sculpture. Suture strongly constricted. Periphery of the last whorl inflated and strongly rounded. Base inflated and strongly rounded and marked like the spire. Aperture broadly oval. Peristome double, the inner slightly exserted and reflected; the outer more or less broadly expanded, fluted, and marked by fine concentric lines. The outer peristome is cut on the middle of the inner lip posterior to which it is reflected over the umbilicus and parietal wall. The breathing pore is on the parietal wall near the posterior angle of the aperture at a little distance behind the peristome. Operculum with subcentral nucleus. The outside of the last whorl is covered by a rather thick deposit of fine calcareous granules, which are somewhat fluted.

The type, U.S.N.M. no. 499582, comes from the west end of El Queque. It is a complete specimen, has 7.5 whorls, and measures: Length, 30.7 mm; greater diameter, 18.8 mm; lesser diameter, 13.2 mm.

The species ranges through the Vinales region. It is also found in Dos Hermanos and Puertecitas.

**CHONDROTHYRETES PARILIS, new species**

Shell elongate-ovate, varying in color from pure milk white through straw-color, horn-color, orange, and dark brown. It may be unicolor, variegated or marbled, usually the latter. The outer, broadly expanded peristome also varies in color from pale yellow to deeper yellow and is rayed in all specimens but the alabastrian form of *C. parilis simonis*. Nuclear whorls about 2, well rounded, smooth. The postnuclear whorls are moderately rounded and marked by slender retractively curved riblets and spiral threads, the latter considerably stronger than the axial riblets. The junctions of the two form nodules on the early whorls, which become weakened on the later turns. Suture moderately constricted; periphery well rounded. Base short, well rounded. Aperture oval. Peristome double, the outer broadly flaringly expanded and marked by numerous slender concentric lamellae adnate to the preceding turns at the posterior angle and deeply cut in the middle of the inner lip. The part posterior to it reflected over and covering the umbilicus. Parietal wall covered by a broad callus. Operculum typically chondropomoid.

This species ranges through the small mogotes west and south of the Sierra San Andrés as well as the Sierra San Andrés.

**KEY TO THE SUBSPECIES OF CHONDROTHYRETES PARILIS**

Spiral threads conspicuously white.

Shell dark brown or red..... *scalaris*

Shell not dark brown or red.

Shell horn-color.

Outer lip conspicuously rayed..... *parilis*

Outer lip not conspicuously rayed..... *simonis*

Spiral threads not conspicuously white.

Shell dark brown or reddish..... *fossularis*

Shell horn-color..... *amoena*

**CHONDROTHYRETES PARILIS SCALARIS, new subspecies**

**PLATE 23, FIGURE 1**

This race comes from the Escaleras de San Andrés. It is an exceedingly dark race, with rayless orange-colored outer peristome and with the spiral threads white, which gives it a very striking color pattern that readily distinguishes it from all the other races.

The type, U.S.N.M. no. 468953, has 5.0 whorls and measures: Length, 25.8 mm; greater diameter, 16.2 mm; lesser diameter, 13.0 mm.

**CHONDROTHYRETES PARILIS PARILIS, new subspecies**

PLATE 23, FIGURE 3

In this race, which comes from Hoyo San Antonio, Mogote de la Jagua, the shell also has conspicuous spiral bands, but the ground color is horn-color, and the outer peristome is conspicuously rayed. There are also inconspicuous interrupted spiral bands of brown.

The type, U.S.N.M. no. 492961, has 5.2 whorls remaining and measures: Length, 24.7 mm; greater diameter, 16.3 mm; lesser diameter, 11.1 mm.

**CHONDROTHYRETES PARILIS SIMONIS, new subspecies**

PLATE 23, FIGURE 6

This race comes from the Mogote Palmero, which is also called Mogote Simon. Here we have the last whorl also bearing light spiral threads, but the ground color is orange or orange-brown, the nuclear whorls are white, and the outer peristome is without rays or almost so.

The type, U.S.N.M. no. 468951, a complete specimen, has 7.2 whorls and measures: Length, 24.5 mm; greater diameter, 15.6 mm; lesser diameter, 10.4 mm.

Of this species we have two albinos, both alabaster white.

**CHONDROTHYRETES PARILIS FOSSULARIS, new subspecies**

PLATE 23, FIGURE 4

This race comes from Hoyo Corto de San Antonio, Asiento de la Jagua. It is a very dark colored race, in which the spiral threads are not light. It varies in coloration from orange to dark brown and has the expanded peristome, which is orange, very conspicuously rayed. The shell may be unicolor, barring the banding at and behind the peristome, or it may be variously banded with interrupted spiral zones of brown.

The type, U.S.N.M. no. 468820, has 4.4 whorls remaining and measures: Length, 22.0 mm; greater diameter, 14.1 mm; lesser diameter, 10.4 mm.

**CHONDROTHYRETES PARILIS AMOENA, new subspecies**

PLATE 23, FIGURE 7

This race was collected by Arango at Mogote de la Jagua de Azua. It is pale, with a horn-colored ground color and with or without



slender interrupted spiral bands of brown. The peristome is of the same color as the ground color of the shell except for the numerous very decided rays present on both sides of the expanded portion.

The type, U.S.N.M. no. 367881, has 5.5 whorls remaining and measures: Length, 24.9 mm; greater diameter, 15.5 mm; lesser diameter, 11.0 mm.

### CHONDROTHYRELLA, new genus

Shell small, varying in shape from ovate to subglobular. The shells may be unicolor or spirally banded. Nuclear whorls about 2, well rounded, smooth except the last part of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls more or less inflated, strongly rounded, latticed with slender axial riblets and spiral threads, which may form cusps at their intersections. Suture well impressed, simple. Periphery strongly rounded. Base more or less inflated, strongly rounded, marked by the continuations of the axial ribs and spiral threads. Umbilicus open or closed. Aperture broadly oval to subcircular. Peristome double, the inner little exerted, the outer expanded, cut or folded on the inner lip and more or less reflected over the umbilicus; parietal wall covered with a strong callus. A breathing pore is present a little within the edge of the aperture on the parietal wall near the posterior angle. This may open into the exterior at the posterior angle where the whorls are solute or into the umbilicus by means of a canal below the parietal callus; breathing may take place through the umbilicus or when this is closed through the decollated apex. Operculum simple, paucispiral, with more or less of a granular calcareous deposit.

Type: *Chondrothyrella* (*Chondrothyrella*) *pudica* (Orbigny).

This genus of small species is confined to the eastern part of Pinar del Rio Province and the western and central parts of Habana Province.

#### KEY TO THE SUBGENERA OF GENUS CHONDROTHYRELLA

Umbilicus open.....	<i>Plicathyrella</i>
Umbilicus closed.....	<i>Chondrothyrella</i>

### PLICATHYRELLA, new subgenus

*Chondrothyrella* with the umbilicus open. Breathing pore opening directly to the exterior where the last whorl is solute or through a channel in the parietal callus, connecting with the umbilicus where the last whorl is adnate to the preceding turn. Outer peristome of the inner lip not cut but folded in the middle.

Type: *Chondrothyrella* (*Plicathyrella*) *assimilis* (Gundlach) Pfeiffer.

## KEY TO THE SPECIES OF SUBGENUS PLICATHYRELLA

Surface of shell filelike.....	claudicans
Surface of shell not filelike.	
Shell chestnut-brown .....	tenebrosa
Shell horn or straw-colored.....	assimilis

## CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS (Gundlach) Pfeiffer

Shell varying from small to medium size in the different races, ovate, usually horn-color, sometimes brown, almost always interruptedly spirally banded with brown. Nuclear whorls about 2, inflated, strongly rounded, microscopically granulose; the initial portion of the first turn dark brown, the rest horn-color. Postnuclear whorls very strongly inflated and rounded, crossed by numerous more or less crowded, retractively slanting, axial riblets that vary from threads to slender low lamellae in the different races. The spiral sculpture consists of threads, which are also quite variable in strength in the divers races. The junction of these two elements renders the axial ribs somewhat sinuose and feebly nodulose at their meeting. Suture well constricted. Periphery and base inflated, strongly rounded, the latter openly umbilicated and marked by the continuation of the axial ribs and spiral threads. The last, however, are much stronger about the umbilical region than on the posterior portion of the base. Aperture very broadly oval; peristome double, the outer broadly expanded and reflected, more so on the inner lip than the rest, marked by radial flutings and concentric lamellae. The middle of the outer peristome of the inner lip bears a fold which in some of the races almost amounts to a cut. The part posterior to this is reflected as a flap over the umbilicus, partly covering, or at least shielding it. Operculum thin, red or reddish, corneous with excentric nucleus, covered by a heavy deposit of fine calcareous granules.

Of the animal of *C. (P.) assimilis assimilis* Gundlach says \*: "Animal whitish, head with scarcely darker suffusion. Tentacles ochre colored with gray tip." When at rest it suspends itself with a moderately long thread.

This species extends through the mountains of a considerable part of eastern Pinar del Rio Province. It has been found from the Sierra la Guira to Pan de Guajaibon east to Mogote de Soroa.

Distribution of the subspecies of *C. (P.) assimilis* is shown in figure 98.

\* Malakozool. Blätter, vol. 10, p. 186, 1863.

KEY TO THE SUBSPECIES OF *CHONDROTHYRELLA* (*PLICATHYRELLA*) *ASSIMILIS*

Early postnuclear whorls distantly ribbed.

Surface of shell exceedingly rough----- *abronensis*

Surface of shell not exceedingly rough.

Peristome radially rayed.

Spiral cords in the umbilicus very strong----- *maceoi*Spiral cords in the umbilicus not very strong----- *signata*

Peristome not radially rayed.

Spiral threads about the umbilicus rather distantly

spaced----- *assimilis*

Spiral threads about the umbilicus closely spaced.

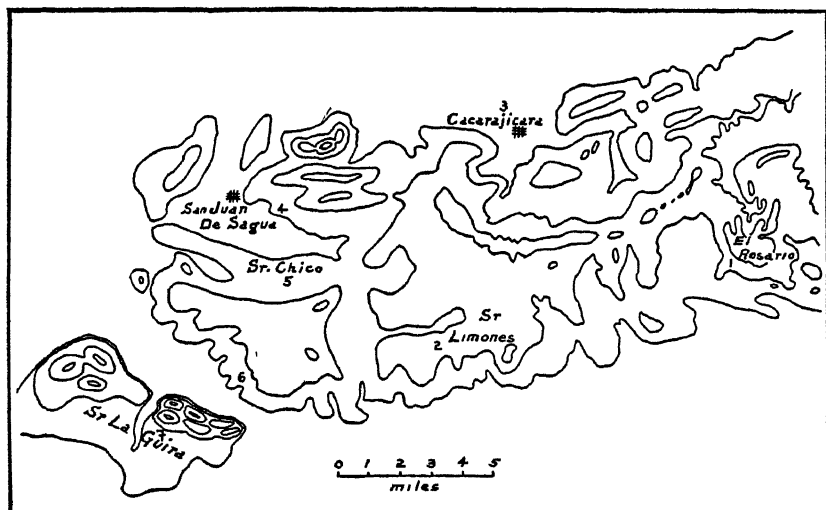
Spiral threads about the umbilicus very strong----- *cisnerosi*Spiral threads about the umbilicus not very strong-- *guirensis*Early postnuclear whorls closely ribbed----- *gemma*

FIGURE 98.—Distribution of the subspecies of *Chondrothyrella* (*Plicathyrella*) *assimilis*: (1) *cisnerosi*; (2) *abronensis*; (3) *maceoi*; (4) *assimilis*; (5) *signata*; (6) *gemma*; (7) *guirensis*.

*CHONDROTHYRELLA* (*PLICATHYRELLA*) *ASSIMILIS ABRONENSIS*, new subspecies

## PLATE 25, FIGURE 5

This race comes from El Abron, Sierra de Limones. The junctions of the sublamellar axial ribs and spiral threads form very strong cusps, which give to this subspecies a rasplike surface. The peristome is radially rayed with brown and the early postnuclear whorls are distantly ribbed.

The type, U.S.N.M. no. 492732, a complete specimen, has 6 whorls and measures: Length, 13.0 mm; greater diameter, 10.2 mm; lesser diameter, 6.8 mm.

## CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS MACEOI, new subspecies

## PLATE 25, FIGURE 2

This race comes from Cacarajicara, 2 miles west of Rancho Lucas. It has the early postnuclear whorls distantly ribbed and the peristome radiatingly rayed with chestnut-brown; there is also a spot of the same color at the notch of the inner lip. The interrupted spiral bands of brown are narrow and faint on the spire but broader and a little more pronounced on the periphery and base. The spiral threads on the anterior half of the base are very strong, which will help to differentiate this easily from *C. (P.) assimilis signata*.

The type, U.S.N.M. no. 468743, has 4.5 whorls remaining and measures: Length, 15.0 mm; greater diameter, 12.5 mm; lesser diameter, 8.2 mm.

## CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS SIGNATA, new subspecies

## PLATE 25, FIGURE 7

This subspecies comes from the Sierra Chica south of Pan de Guajaibon. It differs from typical *C. (P.) assimilis assimilis* in having the peristome radiatingly rayed, and in having a faint dark line at the edge of the summit of the whorls, and from *C. (P.) assimilis maceoi* in having the spiral cords about the umbilicus much less strongly developed. The decidedly inflated whorls are distantly ribbed on the early turns, but here the ribs closely approximate on the last whorl where the spaces that separate them are almost as narrow as the ribs, which are sublamellar and low. The interrupted spiral bands are almost continuous. The peristome of the inner lip is very broad and the flexure not profound.

The type, U.S.N.M. no. 468744, has a little more than 4 whorls remaining and measures: Length, 15.6 mm; greater diameter, 12.0 mm; lesser diameter, 8.3 mm.

## CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS ASSIMILIS (Gundlach) Pfeiffer

## PLATE 25, FIGURE 1

1863. *Chondropoma assimile* (GUNDLACH PFEIFFER, Malakozool. Blätter, vol. 10, p. 186.

1920. *Chondrothyra (Chondrothyretes) assimile* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

This subspecies comes from San Juan de Sagua, the southwest side of Pan de Guajaibon. It has the early postnuclear whorls rather distantly ribbed; the peristome is pale yellowish, without brown radiating rays. It also has the spiral threads on the anterior half of

the base fewer and much more distantly placed than those of *C. (P.) assimilis guirensis*, which it most nearly resembles.

The type, U.S.N.M. no. 468745, is a complete specimen, having 6.4 whorls and measuring: Length 16.3 mm; greater diameter, 11.8 mm; lesser diameter, 8.2 mm.

**CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS CISNEROSI, new subspecies**

**PLATE 25, FIGURE 6**

This, the largest race of *C. (P.) assimilis*, was collected by Cisneros in the Sierra Rosario. It is dark horn-color, and the broken tip shows the dark columella. It is reticulately latticed but only feebly cusped at the intervals of the axial riblets and spiral threads. Within the umbilicus the spiral threads are very strong and rendered conspicuously cusped by the axial threads.

The type, U.S.N.M. no. 367882, has 3.9 whorls remaining and measures: Length, 15.3 mm; greater diameter, 12.8 mm; lesser diameter, 9.1 mm.

**CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS GUIRENSIS, new subspecies**

**PLATE 25, FIGURE 4**

This race was collected by Arango in the Sierra la Guira northwest of San Diego de los Banos. It has the axial riblets on the early post-nuclear whorls very distantly spaced, while those of the last whorl are but slightly elevated and separated by spaces as wide as, or only a little wider than, the ribs. In this subspecies the spiral threads on the anterior part of the base are less strong, more numerous, and closer spaced than in *C. (P.) assimilis assimilis*, with which it shares a faintly yellow peristome.

The type, U.S.N.M. no. 367886, has 4.7 whorls remaining and measures: Length, 14.0 mm; greater diameter, 11.0 mm; lesser diameter, 7.5 mm.

**CHONDROTHYRELLA (PLICATHYRELLA) ASSIMILIS GEMMA, new subspecies**

**PLATE 25, FIGURE 3**

This, the smallest of all the races of this species, comes from Mogote Colorado, one of the limestone blocks on the east side of the Rio San Diego, a short distance north of San Diego de los Banos. Its minute size, combined with the closely spaced axial riblets on the early post-nuclear whorls, readily distinguishes it from the other subspecies.

The type, U.S.N.M. no. 468747, has 5.8 whorls remaining and measures: Length, 11.4 mm; greater diameter, 7.7 mm; lesser diameter, 5.9 mm.

## CHONDROTHYRELLA (PLICATHYRELLA) CLAUDICANS (Poey)

Shell small, very broadly ovate, when truncated almost subglobular, varying in color from horn-color through orange to brown, unicolor or interruptedly spirally banded. The first portion of the nucleus is blackish brown, the rest much lighter. Peristome pale yellow. Nuclear whorls about 2, inflated, strongly rounded, smooth except for microscopic granules. Postnuclear whorls decidedly inflated, gibbose, strongly rounded, marked by retractively curved, axial riblets, which vary in strength from threads to low lamellae. The spiral sculpture also consists of threads, which vary considerably in strength, numbers, and spacing in the different races and also in the way they render the axial riblets wavy and nodulose at their junction. The axial riblets continue over the inflated periphery and base of the last whorl into the umbilicus undiminished; the spiral threads, however, become stronger and more distantly spaced in most of the races on the anterior half of the base and in the umbilicus. Aperture very broadly ovate; peristome double, the outer broad, flaringly expanded; on the inner lip posterior to the fold almost triple the width of that of the outer lip. The outer peristome is radially fluted and marked with concentric, thin lamellae. The inner peristome is narrow, slightly exserted and reflected. The operculum is thin and reddish, has an excentric nucleus, and is covered by a deposit of minute calcareous granules.

Of the animal *C. (P.) claudicans claudicans* Gundlach is quoted by Pfeiffer as saying<sup>6</sup>: "Animal pale gray with lighter dots; on the edge of the side of the snout a dark spot is present. Tentacles of orange color with a clay yellow suffusion of coral-red with brownish lip." Here he also quotes Poey as saying that the animal with an alternate lateral motion, resting now on the right side of the foot, then on the left. When at rest it suspends itself by a mucous thread.

This species we found hybridizing with *Chondrothyrella (Chondrothyrella) perturbata* in the gorge of the Rio Taco Taco.

## KEY TO THE SUBSPECIES OF CHONDROTHYRELLA (PLICATHYRELLA) CLAUDICANS

Sculpture consisting of rather sharp cusps..... *claudicans*

Sculpture consisting of small nodules..... *culminis*

## CHONDROTHYRELLA (PLICATHYRELLA) CLAUDICANS CLAUDICANS (Poey)

## PLATE 27, FIGURE 4

1851. *Cyclostoma claudicans* POEY, Memorias sobre la historia natural de la Isla de Cuba, pp. 100-106, 444-446, 454, pl. 7, figs. 8-11.

1852. *Chondropoma claudicans* PFEIFFER, Monographia pneumonopomorum viventium, vol. 1, pp. 295-296 (in part).

1920. *Chondrothyra (Chondrothyretes) claudicans* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

<sup>6</sup> Malakozool. Blätter, vol. 3, p. 135, 1856.

**CHONDROTHYRELLA (PLICATHYRELLA) TENEBROSA TENEBROSA (Morelet)****PLATE 27, FIGURE 3**

1849. *Cyclostoma tenebrosus* MORELET, Testacea novissima insulae Cubanae et Americae Centralis, pp. 23-24.

1852. *Chondropoma tenebrosus* PFEIFFER, Monographia pneumonopomorum viventium, vol. 1, pp. 295-296.

1920. *Chondrothyra* (*Chondrothyretes*) *tenebrosa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 64.

This subspecies comes from Rancho Lucas on the northeast side of Pan de Guajaibon. It has the peristome and callus of the parietal wall chestnut-brown.

The specimen figured, U.S.N.M. no. 11026, was collected by Wright; it has 4.5 whorls remaining and measures: Length, 16.5 mm; greater diameter, 13.0 mm; lesser diameter, 18.9 mm.

**CHONDROTHYRELLA (PLICATHYRELLA) TENEBROSA CAIMITENSIS, new subspecies****PLATE 27, FIGURE 5**

In this race, from Caimito, southwest of Pan de Guajaibon, the peristome is yellow, with a brownish wash. The part of the outer peristome on the inner lip posterior to the fold is definitely pale chestnut-brown; the rest is rayed with radiating zones of brown.

The type, U.S.N.M. no. 11003, was also collected by Wright. It has 4.3 whorls remaining and measures: Length, 14.9 mm; greater diameter, 12.2 mm; lesser diameter, 7.8 mm.

**CHONDROTHYRELLA (PLICATHYRELLA) TENEBROSA SUBTENEBROSA, new subspecies****PLATE 27, FIGURE 1**

This subspecies was collected by Wright at Pinalillo, Sitio del Pinar, north-central part of Pan de Guajaibon. It has the peristome pale yellow, without radiating rays.

The type, U.S.N.M. no. 367885, has 4.5 whorls remaining and measures: Length, 16.1 mm; greater diameter, 12.8 mm; lesser diameter, 8.2 mm.

**CHONDROTHYRELLA, new subgenus**

*Chondrothyrella* with the umbilicus closed by the reflected inner lip of the outer peristome. The breathing pore connects with the umbilicus by a slender space in the parietal callus; the breathing is accomplished through the hollow axis and the decollated apex.

Type: *Chondrothyrella* (*Chondrothyrella*) *pudica* (Orbigny).

## KEY TO THE SPECIES OF SUBGENUS CHONDROTHYRELLA

- Axial sculpture very fine and closely spaced----- *pudica*  
 Axial sculpture only moderately fine and not closely spaced.  
   Umbilicus open or closed; tip cinnabar red----- *perturbata*  
   Umbilicus closed; tip not cinnabar red.  
     Shell straw-color----- *excisa*  
     Shell not straw-color.  
       Shell brown.  
         Columella with a red spot----- *ottonis*  
         Columella without a red spot.  
           Shell broadly ovate----- *cuzcoensis*  
           Shell ovate----- *petricosa*

## CHONDROTHYRELLA (CHONDROTHYRELLA) PUDICA (Orbigny)

## PLATE 24, FIGURES 3, 4

1842. *Cyclostoma pudicum* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'île de Cuba*, vol. 1, pp. 259-260, pl. 22, fig. 6, 7, 8'', not 8 or 8'.
1851. *Cyclostoma sericatum* MORELET, *Testacea novissima insulae Cubanae et Americae Centralis*, pt. 2, p. 20.

Shell broadly ovate, almost turbinate, varying in general tone of color from brown to plum color. Nuclear whorls flesh-color, with a dark point at the tip, gradually turning darker toward the end of the nuclear spire. The peristome is yellowish white. Nuclear whorls 2.2, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, slender, sublamellar axial riblets, which are more distantly spaced on the early whorls than on the last, where they are rather crowded. The spiral sculpture consists of threads, which are a little stronger than the axial riblets. The intersections of the axial riblets and the spiral threads form weak elongated nodules having their long axis parallel with the axial sculpture. Suture strongly constricted. Periphery of the last whorl inflated, strongly rounded. Base short, inflated, strongly rounded with a rather well-impressed umbilical region, which is marked by the continuations of the axial riblets and spiral cords. The latter are a trifle stronger on the base than on the posterior portion of the whorl. Aperture large, very broadly oval; peristome double, the outer broadly expanded, not quite all in one plane, marked by concentric lines of growth and radiating corrugations; the outer peristome is deeply notched a little anterior to the middle on the inner lip; the portion posterior to this notch is reflected over the umbilical area as a broad callus completely covering the umbilicus; on the parietal wall the outer peristome is reflected over the preceding turn and adnate to it; the inner scarcely at all



elevated above the outer, slightly reflected and appressed to it. The breathing pore is at some little distance behind the peristome on the parietal wall and close to the posterior angle of the aperture. The operculum is thin, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

This species was found abundantly on the limestone cliffs and talus slopes on the north side of Mount Guajaibon, near the western end of the mountain, Pinar del Rio, Cuba.

The specimen described and figured is a complete individual, having 6.0 whorls, and measuring: Length, 14.2 mm; greater diameter, 10.2 mm; lesser diameter, 7.5 mm.

The chubby shape, fine sculpture, and dark color pattern with the brilliantly contrasted peristome give this race a very distinct aspect.

This species was described by Orbigny in 1842 in Sagra's *Histoire de l'Île de Cuba*, vol. 1, pp. 259-260, and figured on plate 22, figures 6, 7, and 8'', but not 8 or 8'. Figures 8 and 8' represent an operculum belonging to *Rhytidothyra bilabiata* Orbigny, the shell of which is figured on the same plate as 3, 4, and 5, but without operculum. The case simply represents a transposition of the operculum from the one species to the other. Morelet, failing to recognize this transposition, renamed the shell *Cyclostoma sericatum*.

CHONDROTHYRELLA (CHONDROTHYRELLA) PERTURBATA, new species

PLATE 24, FIGURE 2

Shell very broadly ovate, the nuclear tip with an orange initial portion followed by horn-colored turns. The postnuclear whorls are bright orange, which usually becomes diluted on the last or sometimes the last two turns. Peristome pale yellow. Nuclear whorls a little more than 2, strongly rounded, smooth; the postnuclear whorls are inflated, strongly rounded, and marked by slender, retractively slanting, axial riblets and stronger spiral threads. The intersection of the two forms elongated nodules whose long axis corresponds with the axial sculpture. The spaces enclosed between the axial riblets and the spiral threads are rectangular pits, having their long axis also in agreement with the axial sculpture. Suture strongly impressed; periphery inflated, strongly rounded. Base inflated, strongly rounded, and marked like the spire. Aperture very broadly oval; peristome double; the inner slightly exerted and appressed to the outer, which is broadly flaringly expanded, somewhat fluted and marked by slender concentric lamina. The outer peristome is cut in the middle of the inner lip and the posterior portion is reflected over the umbilicus as a broad flap, completely closing this. The parietal wall is covered with a heavy callus. Operculum thin, paucispiral, corneous, with a heavy deposit of calcareous granules.

The type, U.S.N.M. no. 422735, was collected by Henderson and Bartsch in the gorge of the Taco Taco River about a mile from its entrance. It has 4.4 whorls remaining and measures: Length, 13.5 mm; greater diameter, 10.8 mm; lesser diameter, 7.0 mm.

This species is a very perturbing element, for we are here undoubtedly dealing with a hybrid problem in which one extreme is exemplified by the above description, and since a large number of individuals in our series represent this type, we are bestowing upon it the name *perturbata*. There are intergrades between this and the openly umbilicated *C. (Plicathyrella) claudicans* (Poey), and the range of color variation extends from the picture portrayed in our description to that of the dark form of typical *C. (P.) claudicans*. It is doubly interesting since two of the subgenera, namely, *Chondrothyrella* and *Plicathyrella*, find representations in the hybrid complex.

CHONDROTHYRELLA (CHONDROTHYRELLA) EXCISA (Gundlach) Pfeiffer

PLATE 24, FIGURE 1

1863. *Chondropoma excisum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 10, pp. 187-188.

Shell very broadly ovate, pale yellow, with interrupted spiral bands of brown. The elements composing these bands are arranged in both axial and spiral series. Nuclear whorls decollated in all our specimens, a portion of the last volution only remaining, which is smooth except that at its termination it shows the beginning of the axial sculpture of the postnuclear turns. Postnuclear whorls strongly rounded, appressed at the summit, marked by slender, almost sublamellose, closely spaced, retractively slanting axial riblets, which are a little more distantly spaced on the early turns than the later. These riblets on the last whorl are separated by spaces about the width of the riblets. The spiral sculpture is very feeble on the first of the postnuclear whorls and slowly increases in strength with the succeeding turns. The spiral threads are considerably stronger than the axial lamellae and render these wavy. Of these spiral threads, 8 are present on the second, 18 upon the third, and the last between the summit and the suture. On the last turn the intersection of the spiral threads with the axial riblets produces elongated oval tubercles, which have their long axis parallel with the axial sculpture. Periphery inflated, strongly rounded. Base short, inflated, broadly umbilicated, well rounded, and marked by the continuations of the axial riblets and 20 spiral threads, equaling those of the anterior portion of the last whorl in strength and spacing. Within the umbilicus the spiral sculpture appears to be absent, at least as far as can be seen through the slit when it is open. Aperture very broadly oval; peristome double, the outer broadly expanded, almost flattened,

marked by concentric lines of growth and almost obsolete corrugations; the outer peristome is cut a little anterior to the middle of the inner lip, and posterior to this it is very broadly expanded to at least treble the width of the rest of the outer peristome, the expanded portion extending over the umbilicus as a fold, which it frequently completely covers though at times only partly so; the outer peristome of the parietal wall is a little narrower than on the rest of the shell and is appressed to and adnate with the preceding turn; the outer peristome shows the color bands as reddish-brown rays; inner peristome somewhat expanded and slightly reflected. The breathing pore is at some little distance behind the peristome on the parietal wall and close to the posterior angle of the aperture. The operculum is thin, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

The specimen described and figured, U.S.N.M. no. 492992, comes from the north side of Guajaibon without specific designation as to what particular portion of the north part. It has a little more than 4 whorls and measures: Length, 12.3 mm; greater diameter, 12.0 mm; lesser diameter, 7.3 mm.

We have also seen this species from Cacarajicara, a little north of Guajaibon.

Of this species Gundlach<sup>8</sup> says: "On paradones on the northern slope of Guajaibon. Animal whitish with still whiter dots on the rugosities and especially about the eyes. Head with reddish suffusion. Antennae coral-red with white tip. When at rest, suspended by a moderately long mucous thread."

**CHONDROTHYRELLA (CHONDROTHYRELLA) OTTONIS (Pfeiffer)**

Shell moderately large, ovate, ranging from flesh-color to purplish brown, unicolor or banded with interrupted spiral bands of brown; peristome white or yellowish. Nuclear whorls 2, well rounded, smooth. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting axial riblets, of which the early ones are usually a little more distantly spaced than the later. The spiral sculpture consists of numerous, very slender threads, like the axial riblets also varying in number and spacing in the different races, Suture well constricted. Periphery well rounded. Base inflated, strongly rounded, and marked by the continuation of the axial riblets and spiral threads, the latter usually a little stronger about the umbilicus than on the rest of the base. Aperture broadly oval; peristome double, the outer flaringly expanded, marked by concentric laminae, deeply notched on the middle of the inner lip, posterior to which it is reflected over the umbilicus which it com-

<sup>8</sup> Malakozool. Blätter, vol. 10, p. 188, 1863.

pletely covers, and frequently also the area adjacent to the umbilicus; on the parietal wall it extends over the preceding turn to which it is adnate. Inner peristome exerted, slightly reflected. Breathing pore on the parietal wall near the posterior angle of the aperture a little behind the peristome. Operculum with the nucleus halfway between marginal and central, the outside covered with a rather thick deposit of calcareous granules.

This species ranges through the mountains north of Candelaria to Cuzco.

The animal of *C. (C.) ottonis ottonis* has the body flesh-color, with smoky suffusion; the eye stalks are coral-red.

KEY TO THE SUBSPECIES OF CHONDROTHYRELLA (CHONDROTHYRELLA) OTTONIS

Peristome with radiating lines of brown..... *ottonis*  
Peristome without radiating lines of brown..... *riohondensis*

CHONDROTHYRELLA (CHONDROTHYRELLA) OTTONIS OTTONIS (Pfeiffer)

PLATE 26, FIGURE 5

1846. *Cyclostoma ottonis* PFEIFFER, Zeitschr. Malak., vol. 3, p. 45.

This subspecies is very abundant along the stone fences and limestone exposures about Taburete, La Tumba, and Soton. It is elongate-ovate, dark in color with feeble brown radiations on the outer peristome.

It differs from *C. (C.) ottonis riohondensis* in having the whorls much less inflated and possessing the radiation of the outer peristome.

The figured specimen, U.S.N.M. no. 499591, was collected by Bartsch at Taburete. It has 4.7 whorls remaining and measures: Length, 18.0 mm; greater diameter, 12.0 mm; lesser diameter, 8.5 mm.

CHONDROTHYRELLA (CHONDROTHYRELLA) OTTONIS RIOHONDENSIS, new subspecies

PLATE 26, FIGURE 4

This race extends through the mountains from Rio Hondo northward through Pena Blanca and El Mulo. It varies somewhat in color but is usually paler than the typical race, with the whorls much more inflated and the peristome white without radiation.

The type, U.S.N.M. no. 493004, comes from Rio Hondo. It has 4.9 whorls remaining and measures: Length, 18.3 mm; greater diameter, 12.9 mm; lesser diameter, 9.3 mm.

CHONDROTHYRELLA (CHONDROTHYRELLA) CUZCOENSIS, new species

Shell varying in shape from ovate to broadly ovate and in color from flesh-color to brown, unicolor or interruptedly spirally lined with brown; peristome white or faintly rayed with brown. Nuclear

whorls about 2, small, strongly rounded, smooth, with a dark spot at the beginning. Postnuclear whorls inflated, strongly rounded, and marked with very slender sublamellar axial ribs, which are closely crowded but only about one-half or less as wide as the spaces that separate them. The spiral sculpture consists of slender threads, which are less strong than the axial riblets and which render these somewhat wavy, scarcely denticulate. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, and marked like the spire. Aperture broadly oval; peristome double, the inner little exerted, reflected upon and adnate to the outer which is broadly expanded, somewhat fluted and marked with feeble concentric lamellae, cut in the middle of the inner lip, with the posterior portion of this covering the umbilicus; parietal wall covered with a heavy callus. Breathing pore on the parietal wall near the posterior angle at some distance from the edge, communicating with the umbilicus and the exterior through the hollow axis and the decollated apex. Operculum paucispiral, covered with a moderately strong calcareous deposit.

This species ranges through the mountains a little east and west and north of Candelaria.

We recognize two subspecies, which the following key will help to distinguish:

KEY TO THE SUBSPECIES OF *CHONDROTHYRELLA* (*CHONDROTHYRELLA*)  
*CUZCOENSIS*

Whorls decidedly inflated..... *caroli*  
Whorls not decidedly inflated..... *cuzcoensis*

*CHONDROTHYRELLA* (*CHONDROTHYRELLA*) *CUZCOENSIS CAROLI*, new subspecies

PLATE 24, FIGURE 5

This race, which is rather thin-shelled, usually pale horn-color, and interruptedly spirally lined, is decidedly inflated and has very many very slender axial riblets. It comes from the region of Soroa.

The type, U.S.N.M. no. 367888, was collected by Carlos de la Torre, Jr., at the Finca Sostenido. It has 3.8 whorls and measures: Length, 15.0 mm; greater diameter, 10.8 mm; lesser diameter, 8.3 mm.

Its decidedly inflated whorls easily distinguish it from *C. (C.) cuzcoensis cuzcoensis*.

*CHONDROTHYRELLA* (*CHONDROTHYRELLA*) *CUZCOENSIS CUZCOENSIS*, new  
subspecies

PLATE 24, FIGURE 6

In this subspecies the shell is much less inflated and the axial riblets a little less slender and less closely spaced than in *C. (C.) cuzcoensis caroli*. Its distribution is more extensive. We have collected

it in the mountains north of Candelaria, at Frias, La Tumba, Finca Dolores, and El Mogote.

The type, U.S.N.M. no. 499592, comes from Loma Pimienta, 7 miles north of Candelaria. It has 4.4 whorls remaining and measures: Length, 14.9 mm; greater diameter, 9.5 mm; lesser diameter, 7.0 mm.

**CHONDROTHYRELLA (CHONDROTHYRELLA) PETRICOSA (Morelet)**

Shell elongate-ovate, thin, varying in color from flesh-color to pale yellow, through pale brown to purplish brown, unicolor or spirally banded; the peristome is yellowish or brownish and rayed. Nuclear whorls 2, well rounded, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Post-nuclear whorls well rounded, slightly shouldered at the summit, marked by retractively slanting, sublamellar axial riblets, which are rather closely spaced. These riblets are rendered wavy by spiral threads, which slightly thicken them at their junction with the axial riblets. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, marked by the continuation of the axial riblets and spiral threads, the latter becoming a little stronger toward the umbilicus. Aperture very broadly oval; peristome double, the outer flaringly expanded, deeply notched on the middle of the inner lip and reflected over the umbilicus and part of the base posterior to the notch, extending broadly upon the preceding whorl on the parietal wall, marked by concentric laminae and slightly fluted; inner peristome slightly exerted and slightly reflected. Breathing pore on the parietal wall near the posterior angle of the aperture and at some little distance behind the peristome. Operculum with the nucleus half way between marginal and central, marked on the outside by a rather thick deposit of calcareous granules.

This race is found over the eastern end of Pinar del Rio, Cuba, and the western end of Habana Province. It breaks up into several subspecies.

Of *C. (C.) petricosa petricosa* collected on stone fences near Vente, Almendares, Habana Province, July 12, 1928, we have the following color note:

Animal flesh-colored, with smoky suffusion and many fine white elongated spots; tentacles dull brownish orange, whitish at base; foot short, bifid; motion of two sides alternate.

**KEY TO THE SUBSPECIES OF CHONDROTHYRELLA (CHONDROTHYRELLA) PETRICOSA**

Sculpture feeble.....	petricosa
Sculpture not feeble.	
Shell dark brown.....	elisabethae
Shell horn color.....	anafensis

**CHONDROTHYRELLA (CHONDROTHYRELLA) PETRICOSA PETRICOSA (Morelet)**

## PLATE 26, FIGURE 2

1851. *Cyclostoma petricosum* MORELET, Testacea novissima insulae Cubanae et Americae Centralis, pt. 2, pp. 19-20.

This subspecies, which was described by Morelet from Almendares, is characterized by its enfeebled sculpture, which gives it a worn aspect. The color of it varies throughout the range of the species, and it is also quite variable in size. It ranges westward to the Sierra Anafe and Guanajay.

The specimen figured, U.S.N.M. no. 492995, is a topotype from Almendares. It has 4.5 whorls remaining and measures: Length, 14.5 mm; greater diameter, 9.8 mm; lesser diameter, 6.9 mm.

**CHONDROTHYRELLA (CHONDROTHYRELLA) PETRICOSA ELISABETHAE, new subspecies**

## PLATE 26, FIGURE 3

This subspecies possesses a much stronger and rougher sculpture than the typical form and is almost black in coloration, with strong radiating rays on the outer peristome.

The type, U.S.N.M. no. 499596, was collected by Dr. Aguayo on the Ariguanabo River. It has 4.3 whorls remaining and measures: Length, 12.8 mm; greater diameter, 9.0 mm; lesser diameter, 6.8 mm.

We have also seen this race from San Antonio and Santiago de las Vegas and the region about Chorrera.

**CHONDROTHYRELLA (CHONDROTHYRELLA) PETRICOSA ANAFENSIS, new subspecies**

## PLATE 26, FIGURE 1

On the summit of the Anafe hills we find a form that, while belonging to this species, differs materially from typical *C. (C.) petricosa*, which is found at the base of the hills, in having the sculpture ever so much stronger and in this respect resembling *C. (C.) petricosa elisabethae*.

The type, U.S.N.M. no. 493001, comes from the summit of Sierra Anafe and has 4.5 whorls remaining. It measures: Length, 15.0 mm; greater diameter, 9.4 mm; lesser diameter, 6.5 mm.

**Genus CHONDROPOMA Pfeiffer**

1847. *Chondropoma* PFEIFFER, Zeitschr. Malak., vol. 6, p. 109.

Shell ranging in form from turbinate to elongate-conic; the sculpture in varying intensity may consist of axial ribs only or of axial

ribs and finer axial threads or of axial ribs and spiral threads. All, even those without spiral sculpture on spire and base, have spiral threads on the umbilical wall. No special breathing device is developed in the members of this genus. The operculum is simple; that is, it consists of a chondroid plate made up of a varying number of whorls, the outer thin edges of which are sometimes faintly upturned to form a suggestion of an obsolete lamella. The outer surface of the operculum has a deposit of calcareous granules, which is usually very slight but in some species rather pronounced. In no instance is this entirely absent. The position of the opercular nucleus, whether excentric or subcentral, depends upon the shape of the aperture.

Type: *Cyclostoma sagra* Orbigny. Selected by Petit in 1850.

#### KEY TO THE SUBGENERA OF GENUS CHONDROPOMA

Junctions of axial ribs and spiral threads forming sharp cusps.

Outer peristome broadly expanded..... *Chondropomartes*

Outer peristome not broadly expanded..... *Chondropomisca*

Junctions of the axial ribs and spiral threads not forming sharp cusps.

Shell very broadly ovate..... *Gutierrezium*

Shell not very broadly ovate.

Axial ribs gathered into tufts at the summit of the whorls.

Axial ribs threadlike; sculpture reticulated..... *Chondropomorus*

Axial ribs sublamellar; sculpture vertebrate..... *Chondropomodes*

Axial ribs not gathered into tufts at the summit of the

whorls..... *Chondropoma*

#### Subgenus CHONDROPOMA Pfeiffer

1847. *Chondropoma* PFEIFFER, Zeitschr. Malak., vol. 6, p. 109.

Shell ranging in form from ovate-conic to elongate-conic. The axial sculpture consists of ribs or riblets, which vary considerably in strength in the different species. The riblets are never gathered into tufts at the summit. The spiral sculpture is also quite variable, but regardless of its strength it is found upon all parts of the spire and base. The peristome may be simple or expanded. No breathing device is present. Operculum typically chondropomoid.

Type: *Cyclostoma sagra* Orbigny = *Chondropoma* (*Chondropoma*) *pictum sagra* Orbigny.

#### KEY TO THE SPECIES OF SUBGENUS CHONDROPOMA

Axial sculpture stronger than spiral.

Shell elongate-conic..... *marginalbum*

Shell ovate.

Suture strongly denticulate..... *carenasense*

Suture not strongly denticulate..... *obesum*



Axial sculpture not stronger than spiral.

Axial and spiral sculpture of equal strength.

Axial ribs strong and distantly spaced..... oxytremum

Axial ribs fine and closely spaced..... edouardi

Axial and spiral sculpture not of equal strength.

Spiral sculpture stronger than axial.

Summit of the whorls strongly denticulate.

Spiral sculpture sublamellar.

Shell moderately slender..... cabrerai

Shell rather stout..... perlatus

Spiral sculpture not sublamellar.

Spiral sculpture consisting of slender threads.

Peristome simple.

Shell elongate-conic..... vespertinum

Shell ovate..... jaulense

Peristome double.

Peristome strongly auriculate at posterior angle.

Postnuclear whorls strongly rounded\_ nicolasi

Postnuclear whorls not strongly rounded.

appendiculatum

Peristome not strongly auriculate at posterior angle.

Outer peristome of inner lip very broad.

pfeifferianum

Outer peristome of inner lip not very broad.

Denticulations at summit distant.

poeyanum

Denticulations at summit very close.

laetum

Summit of the whorls minutely denticulate.

Shell strongly inflated, rotund.

Peristome simple..... moestum

Peristome double.

Suture channeled..... garcianum

Suture not channeled.

Outer peristome rather broadly expanded.

antonense

Outer peristome not broadly expanded... yucayum

Shell not strongly inflated, not rotund.

Shell elongate-ovate.

Suture channeled..... wilcoxi

Suture not channeled.

Peristome simple..... cognatum

Peristome double.

Outer peristome auriculate at

posterior angles..... leoni

Outer peristome not auriculate at posterior angles.

Whorls strongly rounded..... pictum

Whorls almost flattened..... lembeyi

## CHONDROPOMA (CHONDROPOMA) POEYANUM (Orbigny)

Complete shell elongate-conic; truncated shell very elongate-ovate. Ground color ranging from flesh-color through straw-color to pale brown; the whorls are marked by interrupted spiral bands of brown. Nuclear whorls almost 2, forming a somewhat truncated apex; smooth except the last portion of the last turn, which shows indication of both axial and spiral sculpture. The postnuclear whorls are strongly rounded and narrowly shouldered, the shoulder being marked by denticles of somewhat varying strength. The axial sculpture consists of obsolete threads and incremental lines, while the spiral sculpture consists of rather strong, distantly spaced threads. Suture narrowly channeled. Periphery well rounded. Base short, well rounded, narrowly openly umbilicated, marked by the continuation of the lines of growth and spiral cords. There are also spiral cords present on the umbilical wall. Aperture broadly oval; peristome single or double, when double the outer and inner one fused on the outer lip but very distinct on the inner and basal lip. Operculum thin, paucispiral with the nucleus half way between submarginal and subcentral.

Of the animal Gundlach<sup>9</sup> says: "Animal pale, head and tentacles with clay-yellow coloration. Black dots are present on the side flaps of the snout and upon the head and neck. The upper side of the tentacles is blackish and their tip clay-yellow and shining. Eyes small and very dark."

This is a coastwise species that ranges from Santa Cruz del Norte westward to the Cabanas Light.

## KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) POEYANUM

Whorls inflated.

Peristome decidedly thickened..... jibacoense

Peristome not decidedly thickened..... occidentale

Whorls not inflated..... poeyanum

## CHONDROPOMA (CHONDROPOMA) POEYANUM JIBACOENSE, new subspecies

## PLATE 30, FIGURE 5

This is the easternmost representative of this species. It comes from Santa Cruz del Norte, Habana Province. Here we have a comparatively thin shell of pale horn-color, interruptedly spirally banded or maculated with rather broad, poorly developed, and more or less closely spaced denticulations at the summit. The axial sculpture is emphasized more than in the typical race, while the spiral is less developed, and this gives to the posterior portion of the whorl

<sup>9</sup> Malakozool Blatter, vol 3, p 131, 1956

a somewhat feeble obsoletely reticulated aspect. The peristome is thickened and the inner lip conspicuously double.

The type, U.S.N.M. no. 493008, has 3.3 whorls remaining and measures: Length, 12.2 mm; greater diameter, 7.4 mm; lesser diameter, 6.5 mm.

**CHONDROPOMA (CHONDROPOMA) POEYANUM POEYANUM (Orbigny)**

PLATE 30, FIGURE 6

1842. *Cyclostoma poeyanum* ORBIGNY, in Sagra's Histoire physique, politique et naturelle de l'Ile de Cuba, vol. 1, p. 261, pl. 22, figs. 24-27.

1851. *Chondropoma poeyanum* PFEIFFER, Zeitschr. Malak., 1851, p. 172 (in part).

1856. *Chondropoma tenuiliratum* PFEIFFER, Malakozool. Blätter, vol. 3, pp. 48-49.

This subspecies comes from the immediate vicinity of Habana, being particularly abundant about the coastal ridge between Cabanas and Cojimar.

The typical form is more inclined to a cylindro-conic shape than the two other subspecies, which have more inflated whorls. Here we find the range of variation from the simple to the double lip in every gathering, which makes it necessary to fuse *tenuilirata* with this subspecies.

The specimen described and figured, U.S.N.M. no. 104483, has 4.5 whorls remaining and measures: Length, 12.6 mm; greater diameter, 7.2 mm; lesser diameter, 6.0 mm.

**CHONDROPOMA (CHONDROPOMA) POEYANUM OCCIDENTALE, new subspecies**

PLATE 30, FIGURE 7

This race occupies the west range of the species. We have it from Cabanas Light. The shell is thin and shining, and the spiral sculpture is enfeebled, giving the axial sculpture greater prominence by contrast. The whorls are inflated, in this respect resembling *C. (C.) poeyanum jibacoense*, but here the shell is much thinner and the peristome much less thickened and less conspicuously double on the inner lip.

The type, U.S.N.M. no. 367791, comes from Cabanas Light. It has 3.3 whorls remaining and measures: Length, 13.3 mm; greater diameter, 7.8 mm; lesser diameter, 6.3 mm.

**CHONDROPOMA (CHONDROPOMA) LEMBEYI, new species**

PLATE 30, FIGURE 8

The truncated shell is elongate-ovate. The first of the remaining whorls is pale brown, the rest flesh-color, marked by interrupted spiral lines of brown; the elements making up these bands are arranged in both axial and spiral series and not infrequently become

confluent in both directions; the partial wall is purplish brown. The postnuclear whorls are well rounded, narrowly shouldered at the summit, which is finely denticulated, the denticles varying in strength and spacing in different individuals. The axial sculpture consists of slender, retractively slanting threads, while the spiral consists of rather strong spiral cords, of which 7 are present on the first of the remaining turns, 12 on the second, and 13 on the last whorl. Suture well constricted, narrowly channeled. Periphery of the last whorl somewhat inflated, strongly rounded. Base strongly rounded, marked by the continuation of the axial lines of growth and spiral cords, which are as strong as those on the spire. Within the umbilicus, however, the spiral cords become slightly weakened. Umbilicus narrow, open. Aperture rather large, decidedly oblique. Peristome double; the inner slightly exerted; the outer widely expanded all around and a little more so on the columella than the rest, usually adnate to the preceding turn, although in some shells it is free from it, which gives to the last whorl the impression of being slightly solute. Operculum thin, paucispiral, with the nucleus halfway between the submarginal and subcentral, covered on the outside with a thin deposit of calcareous granules.

The type, U.S.N.M. no. 367791, comes from San Antonio de los Banos. It has 4.5 whorls remaining and measures: Length, 14.6 mm; greater diameter, 17.8 mm; lesser diameter, 6.4 mm.

This species has probably been confused in the past with *C. (C.) tenuilirata* Pfeiffer, which we have now been forced to make a synonym of *C. (C.) poeyanum*. It occupies a range south of *pfeifferianum* in Habana Province and is easily distinguished from this by its stronger sculpture and by the fact that the peristome is expanded all around.

CHONDROPOMA (CHONDROPOMA) LEONI, new species

PLATE 30, FIGURE 10

The truncated shell is very elongate-ovate. Nuclear whorls decolled in all our specimens. The remaining whorls flesh-color with interrupted spiral bands of brown, of which the one at the periphery is a little more conspicuous than the rest. This is usually also the case in the one on the middle of the base, which almost equals it in strength. The whorls remaining are well rounded, narrowly obliquely shouldered at the summit, and marked by weak, retractively slanting, axial threads. The spiral sculpture consists of conspicuous spiral threads, of which 10 are present between summit and suture on the first of the remaining whorls and 17 on the rest. The junctions of the axial ribs and spiral threads form very weak indications of nodules, while the spaces enclosed between them form shallow rectangular

pits. Suture not channeled. Periphery of the last whorl strongly rounded. Base narrowly, openly umbilicated, slightly inflated, well rounded, and marked by the continuation of the axial riblets, which here become intensified, and spiral threads equaling those on the spire in strength; within the umbilicus, however, these become a little weaker and more closely spaced. On the base proper the junctions of the axial ribs and spiral threads form slender nodules. Aperture broadly ovate; peristome double, conspicuously expanded all around, the outer forming a rather strong auricle at the posterior angle, less expanded on the posterior half of the outer lip than on the rest, and most expanded on the basal half of the inner lip; the entire outer peristome shows wavy concentric lines; the outer peristome is adnate to the preceding turn on the parietal wall; the inner peristome is somewhat exerted and distinct all around. Operculum thin, paucispiral, with the nucleus halfway between submarginal and subcentral, the outside covered with a thin deposit of fine calcareous granules.

Field notes by Bartsch made on July 27, 1928, describe the animal as follows:

Dorsum pale gray, semitranslucent, with innumerable minute white spots, which are most concentrated about the base of the tentacles and render this area paler than the rest. Edge of snout with a faint olive tinge. Tentacles orange with buffish tip, the latter not expanded. Sides of body and sole of foot gray, with olivaceous tinge. Sole deeply medially cleft; wave motion of the two sides alternate.

The type, U.S.N.M. no. 493032, was collected by John B. Henderson on the north slope of the Sierra de Anafe, Pinar del Rio. It has a little more than 3 whorls and measures: Length, 16.6 mm; greater diameter, 9.6 mm; lesser diameter, 7.9 mm.

The Sierra Anafe has furnished a number of interesting species, and this is another.

The expanded peristome and auriculation at the posterior angle readily distinguish this from the other species that group around *pictum*, *pfeifferianum*, *poeyanum*, and *lembeyi*.

This suggests *Chondropoma* (*Chondropoma*) *cabrerae* but is at once distinguished in having the whorls much more inflated and much weaker sculpture and in having the posterior angle less conspicuously auriculate.

**CHONDROPOMA (CHONDROPOMA) CABRERAE, new species**

**PLATE 30, FIGURE 9**

Shell elongate-conic, the truncated form has almost a cylindric appearance, pale horn ground color, marked by distantly spaced, inter-

rupted spiral spots of brown, which are arranged in axial series and make the dark coloration appear more in the nature of axial streaks than spiral elements. On the base, however, this state of affairs is reversed and the brown spots become almost confluent spirally. This color scheme shines through the thin texture of the outer lip and extends over the pale inner and outer peristome, whose ground color is bluish white. Whorls moderately rounded, rather sharply denticulated on the narrow shoulder and marked by feeble, retractively slanting incremental lines and rather strong flattened spiral cords, of which six are present on the first and second of the remaining turns; on the later a finely intercalated slender thread appears in the middle between these and on the last whorl this thread reaches the strength of the rest. The base bears the same sculpture as the spire, but the spiral sculpture of the umbilical wall is much enfeebled, appearing as mere lines. Suture moderately constricted; periphery somewhat inflated, well rounded. Base short, slightly inflated, well rounded. Aperture broadly oval; peristome double, the inner slightly exerted, reflected over and adnate to the outer. The inner broadly expanded, more so on the columellar wall than on the basal portion of the outer lip, subauriculate at the posterior angle. Operculum paucispiral, with the nucleus halfway between the marginal and sub-central and covered with a thin deposit of calcareous granules.

The type, U.S.N.M. no. 367793, was collected by Cabrera at El Volcan, south of Managua. It has 3.9 whorls remaining and measures: Length, 15.3 mm; greater diameter, 9.1 mm; lesser diameter, 6.7 mm.

In many ways this species resembles *C. (C.) leoni* but differs from it in having the whorls much less inflated and in having the much stronger sculpture.

#### CHONDROPOMA (CHONDROPOMA) PFEIFFERIANUM (Poey)

Shell large, when perfect elongate-conic, when truncated very elongate-ovate, varying from flesh-color to chestnut-brown, with darker interrupted spiral bands of brown; the dots composing these are always arranged in both axial and spiral series and usually become confluent axially, giving the shell an axially banded aspect rather than a spirally banded one. Interior of aperture pale brown. Peristome yellowish horn-color with the dark bands showing. Nuclear whorls almost 2, forming a truncated apex, all smooth except the last portion of the last turn, which shows indication of both axial and spiral sculpture. The postnuclear whorls are moderately well rounded, narrowly shouldered at the summit, which is rendered crenulated by slender nodules. These become very irregular, both in strength and spacing on the later turns. The axial sculpture con-

sists of slender threads on the early whorls which become decidedly enfeebled on the later turns, changing here to mere incremental lines. The spiral sculpture consists of threads, also not strongly developed. The junctions of the axial riblets and spiral threads do not form nodules even on the early turns. Suture narrowly channeled. Periphery well rounded. Base moderately long, somewhat inflated, well rounded, openly moderately broadly umbilicated, marked like the upper portion of the last whorl by incremental lines and spiral threads, those on the umbilical wall equaling those on the outside in strength. The last whorl is usually solute for a slight fraction of a turn. Aperture broadly ovate; peristome double, the outer and inner coextensive on the outer lip, slightly separated on the parietal wall and the basal lip and very strongly so on the inner lip where the outer peristome forms a broadly expanded shelflike element, and the inner projects materially above it at a little less acute angle. Operculum thin, corneous, paucispiral, with the nucleus halfway between submarginal and subcentral, the outside covered with a thin granular deposit.

Of this species Gundlach says<sup>10</sup>: "Animal pale, the interior of the head and neck somewhat rose-colored, which is also the color of the tentacles whose tip is clay yellow. The body is marked above by whitish spots and darkish dots which form a curved band upon the head below the tentacles and still other dots upon the head become concentrated on the edge and form a V-shaped figure with the angle pointing forward. The upper part of the tentacles is rendered grey by a countless number of blackish atoms."

Poey in dedicating this species differentiates it from *C. (C.) pictum*, but he does not mention a type locality. Pfeiffer figures a specimen that plainly shows a member of the complex we now recognize as this subspecies. It probably comes from Mangaro, which we know was one of his collecting grounds.

This is a lowland species, found in the stone fences, under rocks and logs. It also ascends the hills in the region about Habana where it replaces *C. (C.) pictum*.

This species was first collected by Poey at La Loma Tetas de Managua. Pfeiffer later listed it from the Loma Camoa from which he had received specimens collected by Gundlach, and this has been held by some to be the type locality. The typical form, however, must be restricted to Poey's collecting ground, as stated above.

The characteristics of *pfeifferianum* are a denticulated suture, double lip, usually dark inner lip, and usually a dark tip.

<sup>10</sup> Malakozool. Blätter, vol. 3, pp. 132-133.

We are recognizing three subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) PFEIFFERIANUM

Decollated shell more than 14 mm long.

Shell brown----- *camoense*

Shell not brown----- *pfeifferianum*

Decollated shell less than 12 mm long----- *ganuzaense*

CHONDROPOMA (CHONDROPOMA) PFEIFFERIANUM CAMOENSE, new subspecies

PLATE 30, FIGURE 1

This subspecies comes from Camoa, Habana Province. It is the largest race and almost always has a chestnut-brown color, only occasionally are brownish horn-color individuals found.

The type, U.S.N.M. no. 493066, has 4.5 whorls remaining and measures: Length, 21.5 mm; greater diameter, 11.1 mm; lesser diameter, 9.8 mm.

CHONDROPOMA (CHONDROPOMA) PFEIFFERIANUM PFEIFFERIANUM Poey

PLATE 30, FIGURE 2

1851. *Cyclotoma pfeifferianum* POEY, *Memorias sobre historia natural de la Isla de Cuba*, vol. 1, p. 419.

1853. *Chondropoma pfeifferianum* PFEIFFER, *Martini-Chemnitz Conchylien Cabinet*, vol. 1, sect. 19, p. 374, pl. 48, figs. 38-40.

This, the typical race, we have seen from Chorrera, Managua, La Alianza, Tapaste, Loma de Candella, and Loma de Coca in Habana Province. Here the shell is usually flesh-color, though sometimes pale brown. It is interruptedly spirally banded on spire and base with occasionally a continuous peripheral and subperipheral band of brown. It is easily differentiated from *C. (C.) pfeifferianum camoense*, which is larger and almost always brown. *C. (C.) pfeifferianum ganuzaense* is easily distinguished by its smaller size.

The specimen figured, U.S.N.M. no. 493053, is one received from Poey. It quite closely resembles Pfeiffer's figure. It has 3.6 whorls and measures: Length, 14.5 mm; greater diameter, 8.5 mm; lesser diameter, 7.0 mm.

CHONDROPOMA (CHONDROPOMA) PFEIFFERIANUM GANUZAENSE, new subspecies

PLATE 30, FIGURE 3

This subspecies comes from Ganuza, Habana Province. It is a diminutive race, having all the attributes of *C. (C.) pfeifferianum* except size.



The type, U.S.N.M. no. 493064, has 3.2 whorls remaining and measures: Length, 11.9 mm; greater diameter, 7.4 mm; lesser diameter, 6.2 mm.

CHONDROPOMA (CHONDROPOMA) PERLATUM (Gundlach) Poey

PLATE 30, FIGURE 12

1858. *Cyclostoma perlatum* POEY, *Memorias sobre historia natural de la Isla de Cuba*, p. 38.

1858. *Chondropoma perlatum* PFEIFFER, *Monographia pneumonopomorum viventium*, suppl. 1, p. 144.

Shell elongate-conic, thin, pale horn-color, with interrupted spiral bands of brown; the dots composing these bands are placed at considerable distances apart in the spiral series. They are also arranged in axial series and are present on both spire and base, and show within the aperture, which is a trifle paler inside than outside. Peristome soiled white. At the summit of the whorls there are low, feebly developed, distantly spaced denticles of whitish color. Nuclear whorls 2.2, strongly inflated, rounded and smooth, except the last portion, which shows the feeble beginnings of the postnuclear sculpture. Postnuclear whorls well rounded and marked by rather distantly spaced, acute, slender spiral keels, of which 5 are present on the first of the remaining turns in the specimen described, and 9 on the last turn. The axial sculpture is reduced to mere lines of growth on the last turn, being a trifle stronger on the early turns. Suture moderately constricted. Periphery strongly rounded. Base strongly rounded, narrowly openly umbilicated, and marked like the spire. Interior of the umbilicus also marked by spiral cords, but here they are a little broader and more closely spaced. Aperture broadly ovate, slightly oblique; peristome double, the outer broadly expanded on the inner lip, a little less so on the basal and still less so on the outer lip, not conspicuously auriculated at the posterior angle; on the parietal wall it is very narrow and adnate to the preceding turn; the outer peristome is composed of a series of concentric lamellae; inner peristome a little thicker than the outer, moderately elevated above it, slightly expanded and slightly reflected. Operculum thin, corneous, paucispiral with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

The specimen described and figured, U.S.N.M. no. 493071, is a cotype from District Limonar near Matanzas, Cuba. It has a little more than 4 whorls and measures: Length, 15.2 mm; greater diameter, 9.0 mm; lesser diameter, 7.2 mm.

The animal of this species was described from a specimen taken by Bartsch on the mogote opposite Mogote Caoba on the east side of the road between Coliseo and Banos de los San Miguel, July 24, 1928.

The animal is short, with the forehead with numerous short streaks and dots of brown, which give it a marbled appearance. The sole of the foot is flesh-color, with a faint grayish suffusion, cleft deeply medially; the motion of the two sides being alternate. The eyes with a whitish ring, which extends to the base of the tentacles. Immediately beyond these the upper surface of the tentacles for half their length is dirty white, while the under part and the rest are orange with a brownish tinge, except the extreme tip, which is slightly expanded and grayish. There is a darker line composed of numerous fine black dots extending from the tentacles backward on the sides. The side of the body is pale ashy gray, the areolations marked by innumerable white dots.

CHONDROPOMA (CHONDROPOMA) PICTUM (Pfeiffer)

Shell elongate-conic, thin, ranging in color from bluish white through pale straw-color to buff and rather dark purplish brown, unicolor, or marked by interrupted spiral bands of brown, which sometimes become almost continuous. In the dark-colored specimens the bands are obscured but can usually be seen by transmitted light within the aperture. Nuclear whorls almost 2, well rounded, smooth, forming an almost truncated apex. The anterior half of the nuclear turns is pale brown, while the rest is white. Postnuclear whorls well rounded, narrowly shouldered at the summit, marked by obsolete, retractively slanting axial threads and varicial streaks, which are of irregular spacing. At intervals there are obsolete nodulous thickenings of some of the riblets at the summit. The spiral sculpture consists of low rounded threads, which are about as wide as the spaces that separate them. Suture well constricted. Periphery of the last whorl well rounded. Base short, well rounded, narrowly, openly umbilicated, marked by the continuations of the axial sculpture and spiral threads, the latter are here a little less strong than those on the spire, and a little more closely spaced. Both the axial and spiral sculpture are present on the umbilical wall. Aperture moderately large, ovate; peristome simple, slightly expanded and slightly reflected, usually adnate to the preceding turn at the parietal wall. Operculum paucispiral with the nucleus halfway between submarginal and subcentral, the outside covered with a deposit of fine calcareous granules which are laid down in a more or less wavy manner.

This species ranges from Varadero west through Habana to Pinar del Rio Province. It is not confined to paradones but occurs also in

limestone fences and so has wide distribution. It breaks up into a number of subspecies, which are briefly characterized in the adjoining key.

Field notes on the coloration of the animals of a number of these various races were taken by Bartsch in 1928 and are here reproduced.

*Chondropoma (Chondropoma) pictum pictum*

Fundador, Station 2, bluffs of Canimar River below ferry, right side, July 20, 1928.

Animal short, forehead with many short streaks and dots of brown; body behind forehead ashy gray. Ring about base of tentacles pale buff. Tip of mouth a little paler than ring. Tentacles buff below, grayish brown above. The bottom color extends up on the sides. Sides of body and sole of foot ashy gray. Sole of foot deeply medially cleft, locomotion of two sides alternate.

*Chondropoma (Chondropoma) pictum mahoganyi*

Paradones at Rifle range, 2 miles south of Limonar, July 23, 1928.

Animal short, of general buffy tinge, with a dark band across the forehead immediately in front of the tentacles; behind the tentacles it is streaked and spotted with brownish, which gives this part a somewhat marbled effect. Behind this the body is flesh-color, with a pinkish-buff flush, which is also the color of the sides of the body above the foot. Sides of foot pale ashy; sole also ashy but a little paler than the sides, deeply medially cleft. Tentacles buff, with a median dorsal streak of brownish, or in some specimens grayish.

*Chondropoma (Chondropoma) pictum yumeriense*

Vista Alegre, July 19, 1928.

Animal short, forehead with many wark short streaks and dots of brown. Edge of snout smoky flesh-color. Tentacles with the base buffish flesh-color, slightly orange beneath, brownish above. Sides of body smoky gray; sole a little paler.

This in coloration seems intermediate between *yucayum* and *pictum* from Fundador.

*Chondropoma (Chondropoma) pictum celsum*

From Station 19, El Palenque, Matanzas, July 21, 1928.

Animal short with the forehead flesh-color, marked by numerous small, elongate, brownish spots; body behind the forehead soiled flesh-color. Ring about the base of tentacles buff-orange, which is also the color of the tentacles excepting an inner gray core. Tip of tentacles brownish orange. Sides of the body ashy, darkest toward

the base. Sole of foot pale ashy, deeply medially cleft; motion of two sides alternate.

*Chondropoma (Chondropoma) pictum arangoi*

Stone fence between Medoze and Sitio Bonilla, July 28, 1928.

Animal short, flesh-color, with a pinkish flush behind the forehead, which is marked by numerous fine white dots. Sides and sole of foot with a slight smoky suffusion. Tentacles ochraceous, sometimes pale orange.

*Chondropoma (Chondropoma) pictum anafense*

Sierra Anafe, July 27, 1928.

Animal short. Forehead and median dorsal parts marbled with conspicuous dots and streaks of brown, less concentrated about the base of the tentacles where the ground color is best shown. Edge of snout a little paler than the adjoining parts. Tentacles orange with the median dorsal part purplish brown. Sides of body, back to tentacles, smoke gray; the rest behind this flesh-color with a pinkish flush. Sole of foot pale gray with an olivaceous tinge.

KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) PICTUM

- Shell very large and thin; average length 23.2 mm----- celsum  
 Shell less large; average length less than 21 mm and more than 16 mm.  
     Outer peristome flaringly expanded anteriorly----- arangoi  
     Outer peristome not flaringly expanded anteriorly.  
         Shell chestnut-brown or orange, rarely paler----- gouldianum  
         Shell not chestnut-brown or orange.  
             Shell buff with interrupted spiral bands of brown----- mahogani  
             Shell flesh-color with interrupted spiral bands of brown----- mochense  
 Shell small.  
     Shell conspicuously spirally banded.  
         Ground color varying from buff to chestnut-brown----- yumeriense  
         Ground color not varying from buff to chestnut-brown.  
             Ground color flesh-color.  
                 Spiral threads strong----- pictum  
                 Spiral threads feeble.  
                     Average length more than 18 mm----- anafense  
                     Average length less than 13 mm----- sagra  
     Shell not conspicuously spirally banded----- varaderense

CHONDROPOMA (CHONDROPOMA) PICTUM VARADERENSE, new subspecies

PLATE 29, FIGURE 8

This, the easternmost race, comes from Varadero, of the Ilicaco Peninsula. It is a small race, of very pale flesh-color with scarcely any indications of spiral color marking. The peristome is almost as

expanded as in *C. (C.) pictum arangoi* and decidedly thickened all around.

The type, U.S.N.M. no. 493090, has a little more than 3 whorls remaining and measures: Length, 16.9 mm; greater diameter, 10.5 mm; lesser diameter, 8.6 mm.

CHONDROPOMA (CHONDROPOMA) PICTUM PICTUM (Pfeiffer)

PLATE 29, FIGURE 2

1839. *Cyclostoma pictum* PFEIFFER, Wieg. Archiv. Naturg., vol. 1, p. 356.

1846. *Cyclostoma pictum* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, vol. 1, sect. 19, p. 125, pl. 15, figs. 1-11; pl. A, figs. 4-5.

This, the typical race, was described by Pfeiffer from Fundador. He, like ourselves, found it quite abundant on the limestone bluffs of the Canimar River nearby.

It is a small race, rather strongly sculptured, of flesh-color ground color with the merest tinge of yellow, resembling *C. (C.) pictum yumeriense* but having a much more thickened peristome, in which it resembles the much larger *C. (C.) pictum mahogani*.

The specimen figured, U.S.N.M. no. 384845, has 4.5 whorls remaining and measures: Length, 19.2 m; greater diameter, 11.0 m; lesser diameter, 9.2 mm.

CHONDROPOMA (CHONDROPOMA) PICTUM MAHOGANI (Gould)

PLATE 29, FIGURE 1

1842. *Cyclostoma mahogani* GOULD, Journ. Boston Soc. Nat. Hist., vol. 4, cover of part 1.

1844. *Cyclostoma mahogani* GOULD, Journ. Boston Soc. Nat. Hist., vol. 4, p. 495.

This name subsequent to its introduction has met with unfortunate vicissitudes. It was based upon specimens collected by Bartlett, an engineer, at a sugar central near Limonar. Bartlett probably marked them Caoba, the name of a place very close to Limonar. Caoba is the Spanish name for mahogany, hence Gould's name *mahogani*, which has nothing to do with the coloration of the shell. A misinterpretation of this fact has caused confusion of this race with *C. (C.) pictum gouldianum* and *C. (C.) p. yumeriense*.

In this race the shell is rather large, ground color pale buff, which is also the color of the peristome. Interrupted spiral bands of brown mark the spire and, to a slightly lesser degree, the base. It resembles most near *C. (C.) pictum mochense*, but that subspecies is thinner and has flesh-colored ground color and peristome. The differences in the color of the animal are shown under the specific description.

The specimen figured, U.S.N.M. no. 493092, has 4.5 whorls remaining and measures: Length, 24.1 mm; greater diameter, 14.0 mm; lesser diameter, 11.8 mm.

We have seen specimens of this race from Caoba, the Paradones at Esmeralda north of the pass near Coliseo, Sierra Descansia, hill next the cemetery at Coliseo, Paradones east of the pass at Coliseo, and the Paradones at the rifle range at Limonar.

**CHONDROPOMA (CHONDROPOMA) PICTUM YUMERIENSE, new subspecies**

**PLATE 29, FIGURE 6**

This small race, which occupies the Yumeri Valley near Matanzas and is particularly abundant at the Vista Alegre, has in the past been confused with typical *C. (C.) pictum pictum*, from which it is readily distinguished by its weaker sculpture and much less thickened peristome, as well as by its much greater range of color. The ground color here ranges from flesh-color to chestnut-brown. Specimens of this last color resemble *C. (C.) pictum gouldianum* (Poey) but lack the orange lip and are much smaller. Interrupted spiral bands of brown are present on spire and base.

We have figured the type and two specimens to show the range of coloration. The type, U.S.N.M. no. 499602, a complete specimen, has 7.0 whorls and measures: Length, 17.8 mm; greater diameter, 9.3 mm; lesser diameter, 7.6 mm.

**CHONDROPOMA (CHONDROPOMA) PICTUM GOULDIANUM (Poey)**

**PLATE 29, FIGURE 10**

1854. *Cyclostoma gouldianum* POEY, Memorias sobre historia natural de la Isla de Cuba, vol. 1, p. 419.

1858. *Cyclostoma gouldianum* POEY, Memorias sobre historia natural de la Isla de Cuba, vol. 2, pp. 43-44.

This beautiful race was well defined by Poey, but like others it has been confused by contemporary and subsequent students with *C. (C.) pictum pictum*, from which its much larger size and splendid shining chestnut-brown, or at times orange, coloration and orange-colored peristome strikingly differentiate it. It occupies the Abra de Figueroa and Loma Mena of the lower Yumeri Valley.

The specimen figured, U.S.N.M. no. 493037, one of a large series, comes from the Abra de Figueroa. It has a little more than 4 whorls remaining and measures: Length, 26.1 mm; greater diameter, 15.1 mm; lesser diameter, 12.3 mm.

**CHONDROPOMA (CHONDROPOMA) PICTUM CELSUM, new subspecies**

**PLATE 29, FIGURE 9**

This huge race we have collected on the north side of El Palenque, where it extends from the eastern end west through the Sierra Cama-

rones. The shells here are much larger than any we have seen elsewhere, of flesh-color or pale buff ground color, with rather broad interrupted spiral color bands.

The type, U.S.N.M. no. 493040, comes from El Palenque. It has a little more than 4 whorls remaining and measures: Length, 28.0 mm; greater diameter, 16.9 mm; lesser diameter, 13.5 mm. This is an unusually large individual; in contrast to it we may cite the average measurements of a series of specimens from El Palenque: Number of whorls, 3.8; length, 24.2 mm; greater diameter, 15.6 mm; lesser diameter, 11.4 mm.

**CHONDROPOMA (CHONDROPOMA) PICTUM MOCHENSE, new subspecies**

**PLATE 29, FIGURE 3**

The shells that cluster about Ceiba Mocha, a few miles south of El Palenque, resemble *C. (C.) pictum celsum* in coloration but are much smaller and have the peristome much less thickened at the edge.

The type, U.S.N.M. no. 493044, a complete specimen, has 6 whorls, and measures: Length, 22.7 mm; greater diameter, 12.2 mm; lesser diameter, 10.3 mm. A large series of specimens gives the following average measurements: Length, 17.8 mm; greater diameter, 10.5 mm; lesser diameter, 8.9 mm.

**CHONDROPOMA (CHONDROPOMA) PICTUM SAGRA (Orbigny)**

**PLATE 29, FIGURE 5**

1842. *Cyclostoma sagra* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'Ile de Cuba*, vol. 1, p. 263, pl. 22, figs. 21, 23.

Orbigny cites "environs de la Havana" as locality for his *Cyclostoma sagra*. Our specimens from Cojimar, a little south of Habana, appear to satisfy his description and figures.

It is a small race, with the sculpture decidedly enfeebled, in which respect it resembles *C. (C.) pictum anafense*, from which it is distinguished by its smaller size.

The specimen figured, U.S.N.M. no. 493083, has 3.3 whorls remaining and measures: Length, 13.9 mm; greater diameter, 8.0 mm; lesser diameter, 7.5 mm.

**CHONDROPOMA (CHONDROPOMA) PICTUM ARANGOI, new subspecies**

**PLATE 29, FIGURE 11**

This subspecies ranges through the Sitio Bonilla, Sitio Perdido, Escalera de Jaruco, and Tapaste.

It is a rather large pale-colored race that has the outer lip rather flaringly expanded and reflected. The type, U.S.N.M. no. 499601,

comes from Sitio Bonilla, Jaruco, and has a little more than 4 whorls remaining, which measure: Length, 23.7 mm; greater diameter, 14.2 mm; lesser diameter, 11.0 mm.

CHONDROPOMA (CHONDROPOMA) PICTUM ANAFENSE, new subspecies

PLATE 29, FIGURE 4

This subspecies ranges from the Sierra Anafe, through Guanajay to Artemisa.

In its enfeebled sculpture this race resembles *C. (C.) pictum sagra*, from which its larger size will distinguish it.

The type, U.S.N.M. no. 493084 comes from the side of Loma de Anafe. It has a little more than 3 whorls remaining and measures: Length, 16.3 mm; greater diameter, 9.7 mm; lesser diameter, 7.9 mm.

CHONDROPOMA (CHONDROPOMA) YUCAYUM (Presas) Pfeiffer

PLATE 29, FIGURE 7

1863. *Chondropoma yucayum* (PRESAS) PFEIFFER, Malakozool. Blätter, vol. 10, p. 190.

Shell large, short, stout, broadly conic, ranging from flesh-color to pale purple, sometimes unicolor, but usually with interrupted spiral bands of brown, of which the one at the summit is a little broader than the rest, equaling in width the one immediately below the subperipheral on the base. These interrupted spiral bands are arranged in axial as well as spiral series. The interior of the aperture varies in color with the intensity of the outer coloration, the peristome usually being yellowish white. Nuclear whorls 2, well rounded, smooth, forming a rather blunt apex. Postnuclear whorls strongly rounded, inflated, very narrowly shouldered, almost appressed at the summit and marked by numerous low, rounded spiral threads, which are a little wider than the spaces that separate them. In addition to this, there are obsolete, retractively slanting axial threads and finer incremental lines. At irregular intervals there are also varicial axial streaks. At the summit at irregular intervals there are a few scattered ill-defined denticles representing thickenings of some of the ribs. These are best developed on the early turns. Periphery strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked with sculpture like that characterizing the spire. The sculpture on the umbilical wall is a little weaker than the rest. Aperture large, ovate; peristome double, the outer slightly expanded and reflected, the inner almost as broad as the outer and also somewhat expanded and reflected. Operculum paucispiral with submarginal nucleus, the outside covered with a rather thick deposit of rather coarse calcareous granules.



The two specimens, U.S.N.M. no. 29054, were collected by C. Wright. They have 3.8 and 3.6 whorls remaining and measure, respectively: Length, 22.7 and 19.8 mm; greater diameter, 14.7 and 13.4 mm; lesser diameter, 12.2 and 11.6 mm.

This species was described by Presas from the Playa de Indios (Yudios), Matanzas. It is narrowly confined to the region south of the river at Matanzas, extending to the hilltop at Bellamar Cave.

Of the animal of this Bartsch has made the following description:

Animal short, forehead marked by numerous short streaks and spots of brown, which give to it a somewhat marbled appearance. Behind this the body is flesh-color, with a buffish tinge. The edge of the forehead, ring about the eyes, and a narrow triangular area behind these are pinkish buffish. Snout gray, a little paler at the edge of its fork. Tenacles pinkish at base, the rest coral red with a brownish flush on the upper side. Sides of body smoky gray, a lighter median streak between snout and cleft in sole on upper side. Sole smoky gray, deeply medially cleft; motion alternate on the two sides. Under side of body behind operculum flesh-color.

The chubbiness and shortness of the shell distinguish this from *C. (C.) pictum*, from which it is also differentiated by its anatomic characters.

**CHONDROPOMA (CHONDROPOMA) COGNATUM, new species**

PLATE 30, FIGURE 4

Shell of medium size, elongate-conic, thin, semitranslucent, horn-color, with interrupted spiral bands of brown. The spots composing these bands are arranged in both axial and spiral series. Nuclear whorls almost 2, smooth except the last portion of the last turn, which shows faint incremental lines. All the nuclear whorls are of plain color. Postnuclear whorls narrowly tabulatedly shouldered at the summit, marked by retractively slanting, threadlike axial riblets, which are rather strong on the early whorls but become enfeebled on the last turn. These threads are about one-third to one-fourth as wide as the spaces that separate them. They become somewhat expanded at the summit and render this rather conspicuously denticulated. The spiral sculpture consists of slender, low, rounded threads, which are of almost the same width and about one-half to one-third as wide as the spaces that separate them. Suture slightly channeled. Periphery of the last whorl well rounded. Base short, well rounded, openly umbilicated, marked by the continuations of the axial riblets, which here become emphasized as do the spiral threads which, while a little narrower and somewhat wavy, are nevertheless much stronger than those of the spire. Both the axial and spiral sculpture extend within the umbilicus. Aperture large, broadly oval; peristome

simple, slightly expanded and reflected, that of the parietal wall usually free. Operculum thin, paucispiral, with the nucleus almost submarginal, the outside covered with a thin deposit of fine calcareous granules.

The type, U.S.N.M. no. 11008, was collected by C. Wright in the jurisdiction of Colon. It has a little over 4 whorls and measures: Length, 19.9 mm; greater diameter, 11.1 mm; lesser diameter, 8.7 mm.

The specimens before us show great diversity in size, and it is most probable that the smaller ones represent the males. This species, which at first sight suggests *C. (C.) pictum* by its general form and simple peristome, is nevertheless so widely separated from it that we do not hesitate to give it specific rank. The much stronger axial sculpture, the narrow channeled suture, and the numerous fine denticles at the summit easily separate it from the *pictum* group.

**CHONDROPOMA (CHONDROPOMA) VESPERTINUM** Morelet

Shell elongate-conic. The ground color may be flesh-color or pale horn-color, or pale brown, or with purplish tinge. In addition to this, there are interrupted spiral bands of brown both on spire and base, of varying width, intensity, and spacing. The axial riblets are usually a little stronger at the summit, where they terminate as slender white denticles. The inside of the umbilical wall is of a brownish purple, interior of aperture varying with the intensity of the coloration on the outside, but at all times showing the spiral bands where present on the inside of the outer lip. Peristome almost white. The plug at the truncated end usually shines through the substance of the shell as a dark oblique band. Nuclear whorls 2, inflated, well rounded, smooth, except the last portion of the last whorl, which shows the fine beginning of the postnuclear sculpture, forming an almost flattened apex, narrowly shouldered at the summit. Postnuclear whorls marked by feeble, threadlike, retractively slanting, rather closely spaced, axial riblets, which are strongest at the summit which they render finely denticulate. In addition to this, the whorls are marked by slender, low, rounded spiral threads, which are considerably stronger than the axial riblets. These two elements give to the shell a finely fenestrated aspect. Suture rendered rather constricted by the slight shoulder at the summit. Periphery strongly rounded. Base well rounded, openly umbilicate, marked by the continuation of the axial riblets and spiral threads, which are as strong as those on the spire. Within the umbilicus, however, the spiral threads become finer and a little more closely spaced. Last whorl solute for about one-tenth of a turn. Aperture oval, posterior angle rather acute; peristome simple, slightly expanded, and slightly reflected. Operculum thin, paucispiral, with almost submarginal nu-

cleus, the outside marked by a thin deposit of fine calcareous granules.

This species comes from the mountains of the central north coast of the Isle of Pines. Here we have on the west the Sierra Casas and facing it across the river some two miles distant, the Sierra Caballas, while to the north of this is the Sierra Colombo, and about 3 miles northeastward is the Sierra Bibijagua. All these isolated blocks harbor distinct races, which we here recognize.

Of the animal of *Chondropoma* (*Chondropoma*) *dissolutum*, Gundlach<sup>11</sup> says: Animal whitish, especially the tentacles and snout, neck flesh-color. Head with a purplish tinge. The tip of the tentacles a little thicker and brownish. Head and neck grayish but with many black dots which form a V-shaped area upon the head behind the base of the tentacles, and a second similar one behind the snout, which becomes darker posteriorly.

Torre has examined Morelet's types of *Cyclostoma vespertinum* in the British Museum and of them he says: "Three specimens so labeled in Morelet's handwriting. They are, however, the same as *Chondropoma dissolutum* Pfeiffer from the Isle of Pines. The locality Palenque, Mexico, is evidently a mistake."

Pfeiffer's *Chondropoma dissolutum* must, therefore, give way to the older *Chondropoma vespertinum* Morelet.

Distribution of the subspecies of *C. (C.) vespertinum* is shown in figure 100.

#### KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) VESPERTINUM

Shell prevailing brown.

Length of decollated shell more than 19 mm.----- *vespertinum*

Length of decollated shell less than 17 mm.----- *colombense*

Shell prevailing flesh-color.

Shell very thin----- *bibijaguense*

Shell not very thin ----- *caballosense*

#### CHONDROPOMA (CHONDROPOMA) VESPERTINUM VESPERTINUM Morelet

#### PLATE 30, FIGURE 14

1851. *Chondropoma vespertinum* MORELET, Testacea novissima insula Cubanae et Americae Centralis, pt. 2, p. 19.

1854. *Chondropoma dissolutum* PFEIFFER, Malakozool. Blätter, vol. 2, pp. 158-159.

1858. *Chondropoma dissolutum* PFEIFFER, Novitates conchologicae, vol. 1, p. 95, pl. 26, figs. 12-16.

We have discussed the use of the name *C. (C.) vespertinum* of Morelet, who does not help us in the restriction of it to a definite subspecies except that we know from his *Helicina constellata* that he collected in the Sierra Casas. Pfeiffer's figures of *C. (C.) dissolutum* also

<sup>11</sup> Malakozool. Blätter, vol. 3, p. 130, 1856.

argue for such a restriction. For this reason we now restrict the typical form to the Sierra Casas race.

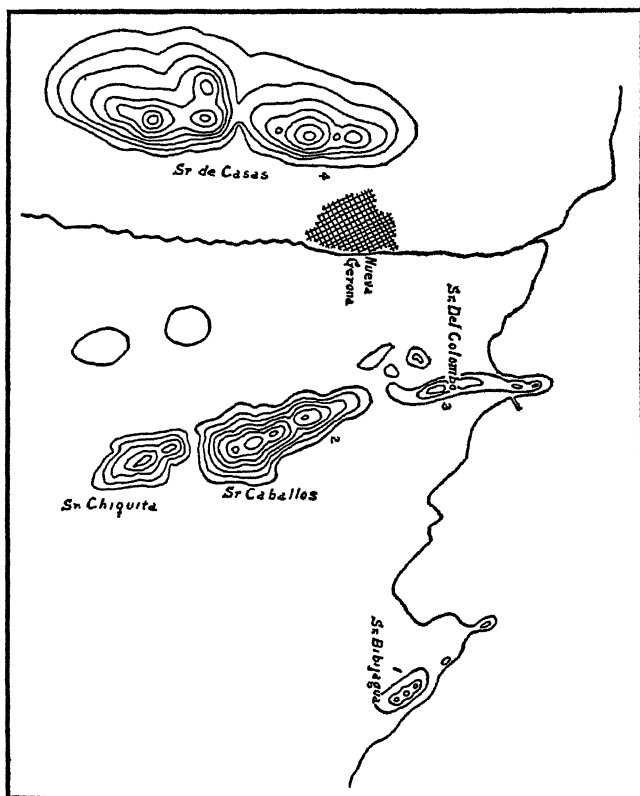


FIGURE 100.—Distribution of the subspecies of *Chondropoma* (*Chondropoma*) *vespertinum*: (1) *bibiyaguense*; (2) *caballosense*; (3) *colombense*; (4) *vespertinum*.

In this subspecies the dark forms prevail; it is stouter than *C. (C.) vespertinum colombense* but less so than *C. (C.) vespertinum caballosense*.

The specimen figured, U.S.N.M. no. 493139, has a little more than 4 whorls remaining and measures: Length, 19.1 mm; greater diameter, 10.3 mm; lesser diameter, 8.8 mm.

It comes from immediately behind Nueva Gerona. Specimens from the southern end of the range are not differentiated.

**CHONDROPOMA (CHONDROPOMA) VESPERTINUM CABALLOSENSE, new subspecies**

PLATE 30, FIGURE 13

Shell larger, a little thinner, and paler than *C. (C.) vespertinum vespertinum*, which renders the interrupted spiral bands more conspicuous.

The type, U.S.N.M. no. 499609, comes from the west side of the center of the main range, south of the road leading to the Presidio. It has a little more than 4 whorls remaining and measures: Length, 20.8 mm; greater diameter, 12.1 mm; lesser diameter, 9.8 mm.

**CHONDROPOMA (CHONDROPOMA) VESPERTINUM BIBIJAGUENSE, new subspecies**

PLATE 30, FIGURE 16

Of this race Bartsch collected two not quite perfect specimens on the west side of the central part of the Sierra Bibijagua, which are so different from the others that they must be noticed. Here the shell is as thin as paper, translucent, flesh-color, and marked with very conspicuous, almost continuous, interrupted spiral lines of brown. The columella and the first of the remaining turns are brown; the peristome is white.

The type, U.S.N.M. no. 499611, has a little more than 4 whorls remaining and measures: Length, 16.4 mm; greater diameter, 11.2 mm; lesser diameter, 8.8 mm.

**CHONDROPOMA (CHONDROPOMA) VESPERTINUM COLOMBENSE, new subspecies**

PLATE 30, FIGURE 15

This race comes from the northwestern end of the Sierra Colombo. It is a dark race like typical *C. (C.) vespertinum vespertinum*, but smaller and slenderer.

The type, U.S.N.M. no. 498144, has 5 whorls remaining and measures: Length, 17.0 mm; greater diameter, 9.6 mm; lesser diameter, 7.3 mm.

**CHONDROPOMA (CHONDROPOMA) WILCOXI Pilsbry and Henderson**

PLATE 31, FIGURE 7

1912. *Chondropoma wilcoxi* PILSBRY and HENDERSON, Nautilus, vol. 26, p. 45.

Shell elongate-conic; when truncated elongate-ovate; pale brown, with interrupted spiral bands of brown a trifle darker than the ground color. The dots composing these bands are rather distantly spaced and are arranged in both axial and spiral series. The interrupted spiral bands of brown are only feebly indicated on the base. The peristome is a little paler than the ground color. Nuclear whorls 2, dark chestnut-brown, the first one being more intensely so than the rest, smooth, strongly rounded, forming an almost flattened apex, the last portion of the last turn shows traces of the beginning of the axial threads. Postnuclear turns well rounded, narrowly shouldered at the summit, marked by slender, retractively slanting, narrow axial riblets, which extend prominently to the summit; in

fact they are a little stronger on the narrowly shouldered summit than on the rest of the turn, appearing here as low lamellae. The spiral sculpture consists of rather strong broad cords, which are a little narrower than the spaces that separate them. There are 7 of these on the first of the remaining turns between summit and suture and 18 on the last immediately behind the peristome. The junctions of the axial riblets and spiral cords form slender tubercles whose long axis is parallel with the axial sculpture. Suture slightly channeled. Periphery of the last whorl inflated, well rounded. Base moderately long, inflated, well rounded, narrowly umbilicated, marked by the continuations of the axial riblets and spiral cords, the latter of about the same strength as those on the spire but a little more distantly spaced near the umbilicus. The umbilical wall is also marked by spiral cords, but here they are a little more closely spaced and a little less strongly developed than those outside of the umbilicus. Aperture broadly oval; peristome double, the outer forming a narrow auricle at the posterior angle, and here consists of a series of concentric lamellae; on the rest of the aperture it extends but slightly beyond the peristome, a little more so on the inner lip than on the outer; the inner peristome is rather strongly developed, thickened and slightly reflected, and but slightly exerted above the inner. Operculum paucispiral, with submarginal nucleus, the outside covered with a rather thick deposit of fine calcareous granules.

The specimen described and figured, U.S.N.M. no. 493145, is a cotype collected by John B. Henderson at Rosario, Ensenada de Cochinas, on the south coast of Cuba. It has a little more than 4 whorls remaining and measures: Length, 19.0 mm; greater diameter, 11.6 mm; lesser diameter, 9.3 mm.

**CHONDROPOMA (CHONDROPOMA) NICOLASI, new species**

Shell of medium size, the truncated specimens ovate; when complete elongate-conic, horn-color or white, unicolor or marked with inconspicuous, interrupted spiral bands of brown. The elements composing these bands are arranged in both axial and spiral series; axially they are rather distantly spaced. The peristome is almost the same color as the ground color of the shell, being only a very little paler. Nuclear whorls about 2, forming a somewhat flattened apex; the first part smooth, the last showing the beginning of the postnuclear sculpture. Postnuclear whorls are strongly rounded, almost inflated, and narrowly shouldered at the summit, marked by slender, retractively slanting, axial, threadlike riblets, which become slightly expanded into flattened crenulations at the summit. The spiral sculpture consists of rather strong cords, which are not quite so wide as the spaces that separate them. The junctions of the axial

threads and the spiral cords form slender nodules whose long axis is parallel with the axial sculpture, but these nodules are not at all conspicuous. Suture strongly constricted, narrowly channeled. Periphery of the last whorl inflated, well rounded. Base short, inflated, well rounded, narrowly openly umbilicate, marked by the continuation of the obsolete axial riblets and spiral cords. The latter are of about the same strength as those on the spire, those on the inside of the umbilical wall being almost as strong as those outside of it. Aperture ovate with an inconspicuous auricle at the posterior angle; peristome double, the outer is reflected obliquely and marked by a series of concentric lines at the auricle and the inner lip; the inner is smooth, also expanded and reflected, almost extending to the outer limit of the outer on the outer lip, while on the inner and basal lip the outer peristome is quite a little broader. Operculum paucispiral, with subcentral nucleus, the outside covered with a rather thick deposit of calcareous granules.

This species appears confined to the Isle of Pines, where we are recognizing three subspecies.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMA*) *NICOLASI*

Spiral sculpture strong	johnsoni
Spiral sculpture feeble.	
Ground color brown	brittoni
Ground color flesh-color	nicolasi

*CHONDROPOMA* (*CHONDROPOMA*) *NICOLASI NICOLASI*, new subspecies

PLATE 31, FIGURE 6

1916. *Chondropoma wilcoxi* HENDERSON, Ann. Carnegie Mus., vol. 10, p. 316 (in part).

This race was collected at Carapatchibey, Isle of Pines, by Dr. Nicolas. It has a flesh-colored ground color, with faint interrupted spiral lines of brown, which appear more like axial streaks than spiral elements. The sculpture is stronger than that of *C. (C.) nicolasi brittoni* and less strong than that of *C. (C.) nicolasi johnsoni*.

The type, U.S.N.M. no. 493148, has a little more than 4 whorls remaining and measures: Length, 14.8 mm; greater diameter, 8.2 mm; lesser diameter, 7.2 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *NICOLASI BRITTONI*, new subspecies

PLATE 31, FIGURE 4

This race was collected by Hermano Leon on the Jorobado Peninsula, Isle of Pines. It has a brown ground color, with decidedly feeble sculpture.

The type, U.S.N.M. no. 493150, has 4.5 whorls remaining and measures: Length, 16.7 mm; greater diameter, 9.9 mm; lesser diameter, 7.9 mm.

**CHONDROPOMA (CHONDROPOMA) NICOLASI JOHNSONI, new subspecies**

PLATE 31, FIGURE 5

This is the smallest race of this species known. The specimens before us of this race were collected by Mr. Johnson and bear the label "Isle of Pines" without specific locality.

Shell white, with the merest indication in places of interrupted brown spiral lirations. The sculpture is much stronger than that of the other two subspecies.

The type, U.S.N.M. no. 499612, is a complete specimen, which has 7.5 whorls and measures: Length, 16.5 mm; greater diameter, 8.0 mm; lesser diameter, 7.4 mm.

**CHONDROPOMA (CHONDROPOMA) CARENASENSE Pilsbry and Henderson**

Shell elongate-conic, or when truncated elongate-ovate, pale brown, marked by interrupted spiral bands of brown, which are arranged in both axial and spiral series. Peristome white. Nuclear whorls almost 2, forming a somewhat truncated apex, the first smooth, the last portion of the last showing indications of both axial and spiral sculpture. Postnuclear whorls narrowly channeled at the summit, which is rendered crenulated by the strong extension of the axial ribs, which are moderately distantly spaced, retractorily slanting, and well developed. The spiral sculpture consists of spiral threads a trifle stronger than the axial riblets and increase in number with the whorls. The junctions of the axial ribs and spiral threads form rounded nodules, which vary in strength with the strength of the spiral threads, the latter varying according to the intercalation of the newer elements. Suture narrowly channeled. Periphery of the last whorl well rounded. Base well rounded, slightly inflated, very narrowly umbilicate, the umbilicus almost covered by the reflection of the outer peristome of the inner lip. The base is marked by the continuations of the axial and spiral threads, which are about as strong as those of the spire, those within the umbilicus being a trifle weaker. Aperture broadly oval; peristome conspicuously double, the outer expanded somewhat flaringly, forming a conspicuous auricle at the posterior angle and adnate to the preceding turn at the parietal wall; the inner projecting decidedly above the outer, mostly so on the outer lip. Operculum corneous, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.



The species apparently ranges along the shoreline from Cayo Carenas of Cienfuegos Bay to Corrientes Bay at the west end of the island. It was also found present on Cayo Cantilles, east of the Isle of Pines. A number of races are recognizable.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMA*) *CARENASENSE*

Diameter of shell more than 7 mm.

Peristome white.

Sculpture very fine..... *toroense*

Sculpture not very fine..... *carenasense*

Peristome yellow..... *corrientesense*

Diameter of shell less than 6 mm.

Peristome white.

Sculpture very fine..... *guauraboense*

Sculpture not very fine..... *rosariense*

Peristome yellow..... *cantillense*

*CHONDROPOMA* (*CHONDROPOMA*) *CARENASENSE* *TOROENSE*, new subspecies

PLATE 32, FIGURE 3

This subspecies, which comes from Cabeza del Toro near Bahia de Cochinos, resembles in general shape *C. (C.) carenasense carenasense* but is even more globose, with the axial ribs much more closely approximated, the spiral sculpture with many more threads, and the interrupted spiral lines more numerous.

The type, U.S.N.M. no. 367796, has 4 whorls remaining and measures: Length, 13.0 mm; greater diameter, 8.0 mm; lesser diameter, 6.5 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *CARENASENSE* *CARENASENSE* Pilsbry and Henderson

PLATE 32, FIGURE 2

1912. *Chondropoma carenasense* PILSBRY and HENDERSON, Nautilus, vol. 26, p. 44.

This race comes from Cayo Carenas and the adjacent mainland. Here the shells are large, flesh-color or white, with the interrupted spiral bands forming axial streaks that are more conspicuous than the spiral lines. The sculpture is more pronounced than in any of the other races, the intersection of the axial ribs and spiral threads forming well-defined cusps.

A cotype, U.S.N.M. no. 493151, has 4.5 whorls remaining and measures: Length, 14.2 mm; greater diameter, 8.0 mm; lesser diameter, 7.2 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *CARENASENSE* *CORRIENTESENSE*, new subspecies

PLATE 32, FIGURE 1

This race, which comes from Corrientes Bay at the western end of Cuba, is as large as *C. (C.) carenasense carenasense*, but the shells

are much more conic in outline, much less strongly crenulated at the summit, and much darker, with the peristome yellow. The sculpture is also finer than *C. (C.) carenasense toroense* and more regular.

The type, U.S.N.M. no. 499613, is a complete specimen of 7.5 whorls and measures: Length, 15.2 mm; greater diameter, 7.7 mm; lesser diameter, 6.2 mm.

CHONDROPOMA (CHONDROPOMA) CARENASENSE GUAURABOENSE, new subspecies

PLATE 32, FIGURE 5

This is a small race of yellow or buff color, except the peristome, which is white. The interrupted spiral bands are inconspicuous, and the sculpture is much more closely spaced than in *C. (C.) carenasense carenasense*.

The type, U.S.N.M. no. 104488, has almost 4 whorls remaining and measures: Length, 9.3 mm; greater diameter, 5.6 mm; lesser diameter, 4.5 mm. It comes from Boca de Guaurabo.

CHONDROPOMA (CHONDROPOMA) CARENASENSE ROSARIENSE, new subspecies

PLATE 32, FIGURE 6

This race comes from Rosario about 15 miles west of Cabeza del Toro. It is exceedingly variable in size. Specimens even slenderer than *C. (C.) carenasense guauraboense* may be found, and from this they increase in size to half that of *C. (C.) carenasense carenasense*. Like *carenasense* the sculpture is sharply cusped.

The type, U.S.N.M. no. 493160, has 5 whorls remaining and measures: Length, 12.0 mm; greater diameter, 6.1 mm; lesser diameter, 5.5 mm.

A complete specimen of 7.1 whorls, on the other hand, measures only: Length, 11.5 mm; greater diameter, 5.3 mm; lesser diameter, 4.4 mm.

CHONDROPOMA (CHONDROPOMA) CARENASENSE CANTILLENSE, new subspecies

PLATE 32, FIGURE 7

This race was collected by Bartsch on Cayo Cantilles east of the Isle of Pines. It equals in size the average of *C. (C.) carenasense rosariense* but is much more yellowish, with yellow peristome and with much finer and more numerous axial and spiral sculptural elements.

The type, U.S.N.M. no. 499614, has a little more than 4 whorls remaining and measures: Length, 11.5 mm; greater diameter, 5.9 mm; lesser diameter, 5.4 mm.

## CHONDROPOMA (CHONDROPOMA) OBESUM (Menke)

Shell elongate-conic when complete or elongate-ovate when truncated, varying in color from gray to orange, white or pale yellow. Nuclear whorls almost 2, forming a blunt apex, the first smooth, the last with indications of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, almost appressed at the summit, marked by slender, retractively curved, axial threads and spiral lirations, the latter a little stronger than the axial threads. The junctions of the two form slender nodules. Suture strongly constricted. Periphery strongly rounded. Base short, inflated, well rounded, openly umbilicate, and marked like the spire. The last whorl appressed to the preceding turn. Aperture broadly oval; peristome double, the outer best shown at the posterior auricle and on the inner lip, the inner peristome is coextensive with the outer. Operculum paucispiral with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

This is a coastwise species and extends from Boca de Camarioca, east of Matanzas, west to Boca de Jaruco, breaking up into four subspecies.

## KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) OBESUM

Diameter of shell more than 9 mm.

Shell pale orange----- obesum

Shell dark orange----- subobesum

Diameter of shell less than 7.5 mm.

Shell gray----- palmasolense

Shell pale orange----- hershei

## CHONDROPOMA (CHONDROPOMA) OBESUM PALMASOLENSE, new subspecies

## PLATE 32, FIGURE 10

This race occupies the region about Palmasola near Boca de Camarioca, which lies halfway between Matanzas and Cardinas. Shell gray and much smaller and more cylindrical when truncated than the others. In this respect it resembles *C. (C.) obesum hershei*, differing from this, however, in coloration.

The type, U.S.N.M. no. 468971, has 4 whorls remaining and measures: Length, 12.7 mm; greater diameter, 7.4 mm; lesser diameter, 6.2 mm.

## CHONDROPOMA (CHONDROPOMA) OBESUM SUBOBESUM, new subspecies

## PLATE 32, FIGURE 9

This race occupies the shoreline west of Matanzas but centers about Punta de Sabanilla. It differs from *C. (C.) obesum obesum* in being much darker orange and a little finer sculptured.

The type, U.S.N.M. no. 468970, comes from Punta de Sabanilla and has a little less than 4 whorls remaining; it measures: Length, 14.3 mm; greater diameter, 9.0 mm; lesser diameter, 7.8 mm.

**CHONDROPOMA (CHONDROPOMA) OBESUM HERSHEY, new subspecies**

PLATE 32, FIGURE 8

This subspecies we have seen from Santa Cruz del Norte, Boca de Jaruco, and Boca de Canasi. It is a small pale-orange race and at times has a subperipheral brown band; in size it is even a little smaller than *C. (C.) obesum palmasolense*, from which the difference in color will at once distinguish it.

The type, U.S.N.M. no. 493173, comes from Santa Cruz del Norte. It has 4 whorls remaining and measures: Length, 11.0 mm; greater diameter, 6.6 mm; lesser diameter, 5.5 mm.

**CHONDROPOMA (CHONDROPOMA) OBESUM OBESUM (Menke)**

PLATE 32, FIGURE 11

1830. *Truncatella obesa* MENKE, Synopsis methodica molluscorum . . ., ed. 2, p. 137.

This race occupies the shoreline immediately east of Matanzas Bay and extends to the Canimar River. It approaches most nearly *C. (C.) obesum subobesum* but is readily distinguished from that by its much paler color.

The specimen figured, U.S.N.M. no. 493162, has a little more than 3 whorls remaining and measures: Length, 13.7 mm; greater diameter, 9.1 mm; lesser diameter, 7.3 mm.

A series of 68 specimens give the following summary measurements:

	Length	Greater diameter	Lesser diameter
	mm	mm	mm
Greatest.....	15 8	9 4	7.7
Least.....	10 3	6 5	5 4
Average.....	13 1	8 1	6.7

**CHONDROPOMA (CHONDROPOMA) MOESTUM (Shuttleworth) Pfeiffer**

Truncated shell ovate, rather thin, varying in color from isabelline to pale horn-color, unicolor or marked with interrupted spiral bands of brown. The elements composing these are frequently also arranged in axial series. In the typical race the shell is unicolor, with bluish lead color, veinlike axial streaks. Nuclear whorls 2, darker than the postnuclear turns, forming a rather pointed apex, having the whorls inflated and strongly rounded. The postnuclear whorls

are marked by rather prominent spiral cords, which increase in number by intercalation as the shell increases in size. On the early whorls there are also rather conspicuous, quite regular and regularly disposed, slightly retractorily slanting, axial threads. These become enfeebled and in some of the races practically obsolete on the last turn. The summit of the whorls is rendered feebly denticulated by the axial markings. Suture well constricted; periphery inflated, strongly rounded. Base inflated, strongly rounded, openly umbilicated and marked with the same sculpture that characterizes the spire. This, however, becomes enfeebled on the umbilical wall. Aperture broadly ovate. Peristome simple, except at the slight auricle at the posterior angle where there is an indication of doubling. Operculum paucispiral with the nucleus halfway between marginal and central, covered with a thin deposit of calcareous granules.

Of the animal of *C. (C.) moestum moralesi*, Bartsch took the following color notes from specimens collected at the type locality of that race, July 15, 1928:

Animal flesh-color, with a pinkish tinge; forehead with numerous grayish spots, which are larger than usual; snout darker than forehead except at edge, which is devoid of spots. Tentacles with orange flesh-colored basal ring and brown tip. Sides of body ashy; foot ashy flesh-color, with brownish tinge medially deeply cleft. Motion of two sides alternate.

This species occupies the coastal region and adjacent hills immediately west of Matanzas Bay.

#### KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMA*) *MOESTUM*

Shell with interrupted spiral bands of brown.

Length of decollated shell more than 16 mm..... *decurrens*

Length of decollated shell less than 13 mm..... *moralesi*

Shell without interrupted spiral bands of brown..... *moestum*

#### *CHONDROPOMA* (*CHONDROPOMA*) *MOESTUM DECURRENS* (Poey)

#### PLATE 31, FIGURE 11

1858. *Cyclostoma decurrens* POEY, Memorias sobre historia natural de la Isla de Cuba, vol. 2, p. 23.

Poey, in his usual lucid way, gives a splendid characterization of this race, which has been confused with typical *C. (C.) moestum moestum* owing in large part, we believe, to mixed collectings. The shells that occupy the region about Punta Sabanilla are typical *C. (C.) m. moestum*, while the present race occupies the region about the Sinclair Oil Co.'s tanks at Dubroc, immediately south of Punta Sabanilla. The shells of this race are thinner, with more numerous, less strong, spiral cords and stronger axial elements amounting almost

to threads, which are quite regularly spaced. Here, too, we have interrupted brown spiral bands.

The specimen figured, U.S.N.M. no. 499616, has almost 4 whorls remaining and measures: Length, 17.4 mm; greater diameter, 12.2 mm; lesser diameter, 10.1 mm.

**CHONDROPOMA (CHONDROPOMA) MOESTUM MORALESI, new subspecies**

PLATE 31, FIGURE 8

This subspecies occupies the La Cumbre ridge, which trends northwest of Matanzas harbor a couple of miles inland. It is a small race having interrupted spiral zones of brown, the dots being usually also arranged in axial series (sometimes the brown markings are absent). Both the axial and spiral sculpture recall *C. (C.) moestum decurrens*, from which it is easily distinguished by its small size.

The type, U.S.N.M. no. 499615, comes from Finca Aurora, La Cumbre. It has 3.8 whorls remaining and measures: Length, 12.1 mm; greater diameter, 8.2 mm; lesser diameter, 6.4 mm.

**CHONDROPOMA (CHONDROPOMA) MOESTUM MOESTUM (Shuttleworth) Pfeiffer**

PLATE 31, FIGURE 12

1854. *Chondropoma moestum* (SHUTTLEWORTH) PFEIFFER, Malakozool. Blätter, vol. 3, p. 132.

This subspecific name we are restricting to the shells from Punta Sabanilla, which are large, of isabelline color, with axial streaks of bluish lead color. Here the axial threads between the rather strong spiral cords are almost absent on the last whorl.

The specimen figured, U.S.N.M. no. 493179, has almost 4 whorls remaining and measures: Length, 17.0 mm; greater diameter, 12.6 mm; lesser diameter, 10.1 mm.

**CHONDROPOMA (CHONDROPOMA) GARCIANUM Torre**

PLATE 31, FIGURE 9

1913. *Chondropoma garcianum* TORRE, Nautilus, vol. 27, p. 37, pl. 3, figs. 2, 3.

Truncated shell broadly ovate, flesh-color. Nuclear whorls decolored in all our specimens. Postnuclear whorls inflated, strongly rounded, and marked by slender threadlike riblets, which become slightly thickened, flattened, and expanded at the angle of the summit. The spiral sculpture consists of rather strong threads, which are considerably farther apart than the axial riblets. The axial riblets and spiral threads enclose slender oblong fenestrations, while their long axis coincides with the axial sculpture. The junctions of the axial riblets and spiral cords form slender nodules on the early

turns but hardly so on the last. Suture narrowly but deeply channeled. Periphery of the last whorl strongly inflated, well rounded. Base short, inflated, well rounded, openly umbilicated, marked by the continuations of the axial riblets and spiral threads equaling those on the spire in strength. Those within the umbilicus are a trifle weaker and a little more closely spaced than those on the outside. Last whorl not solute, or only a trifle so. Aperture broadly oval; peristome double at the posterior angle; there is also a faint indication of an outer peristome on the inner lip; on the outer and basal lip the peristome seems simple. Operculum thin, corneous, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

Three specimens before us come from Palma Sola, Matanzas Province.

The specimen described and figured, U.S.N.M. no. 493185, has a little more than 4 whorls and measures: Length, 15.3 mm; greater diameter, 10.6 mm; lesser diameter, 9.0 mm.

**CHONDROPOMA (CHONDROPOMA) JAULENSE, new species**

**PLATE 30, FIGURE 11**

Shell elongate-conic, varying from horn-color to pale brown, the early whorls usually much darker than the later turns. The latter are usually marked by axial zones of brown, which are somewhat wavy and suggest confluent elements of interrupted spiral bands. Nuclear whorls unknown. The postnuclear whorls are well rounded and marked by rather closely spaced spiral cords, which are almost as broad as the spaces that separate them, and feeble axial riblets, the latter most conspicuous at the summit, which they mark as fine white denticles. Suture moderately constricted; periphery well rounded. Base rather long, well rounded, and marked like the spire, openly umbilicated. The sculpture on the umbilical wall is a little less strong than on the rest of the base. The last whorl is slightly solute. Peristome simple on the outer lip, with a mere line of separation on the parietal wall and double on the inner lip.

This species was collected by Wright at Punta de Jaula.

The type, U.S.N.M. no. 499617, has 4 whorls remaining and measures: Lengths, 15.8 mm; greater diameter, 9.0 mm; lesser diameter, 7.5 mm.

**CHONDROPOMA (CHONDROPOMA) ANTONENSE, new species**

**PLATE 31, FIGURE 10**

Shell elongate-ovate, stout, nuclear whorls decollated in all our specimens. The truncated end dark chestnut-brown, the succeeding

turns very pale brown, the rest horn-color, unicolor or marked with interrupted spiral bands of brown. These bands when present are usually more strongly developed on the early turns than on the later, and are present on both spire and base. The interior of aperture pale buff; peristome yellowish horn-color. The whorls are strongly rounded, narrowly shouldered at the summit, which is rendered feebly crenulated by the occasional thickening of a rib. The axial sculpture consists of very distantly spaced, feeble threads, the rest being reduced to mere indications of feeble nodules at the summit and incremental lines. The spiral sculpture consists of rather strong cords, which are separated by spaces two to four times as wide as the cords. Near the base and on the base the incremental lines become a little stronger and slightly reticulate the spaces between the spiral cords. Suture narrowly channeled. Periphery inflated, very strongly rounded. Base inflated, well rounded, narrowly openly umbilicated, marked by the same type of sculpture as that which characterizes the spire, except in the umbilicus, where the spiral threads become intensified. Aperture ovate; peristome double, the outer narrowly expanded and reflected and rather thickened, adnate to the preceding turn on the parietal wall, the inner also expanded and reflected and projecting a little above the outer. Operculum thin, horny, paucispiral, with the nucleus almost submarginal, covered on the outside with a moderately thick, rather coarsely granular calcareous deposit.

The type, U.S.N.M. no. 493187, was collected on the Tomas Barrera Expedition at Cape San Antonio. It has a little over 3 whorls and measures: Length, 18.7 mm; greater diameter, 12.2 mm; lesser diameter, 10.4 mm.

**CHONDROPOMA (CHONDROPOMA) MARGINALBUM (Gundlach) Pfeffer**

Truncated shell elongate-ovate, pale brown, with faint interrupted spiral bands of brown; peristome white, interior of aperture pale brown. Nuclear whorls almost 2, inflated, strongly rounded, forming a somewhat truncated apex, the first smooth, the last showing the beginning of the postnuclear sculpture. Postnuclear whorls somewhat inflated, marked by strong, closely spaced, slightly retractorily slanting axial riblets which crenulate the narrow summit of the whorls. The spiral sculpture consists of spiral cords which are considerably stronger than the axial riblets, the junction of the axial riblets and spiral cords form elongated nodules, which have their long axis parallel with the axial sculpture. Suture narrowly channeled. Periphery well rounded. Base moderately long, inflated, well rounded, narrowly openly umbilicated, marked by the continuation of the axial riblets and spiral threads with several fine spiral threads on the umbilical wall. Aperture oval; peristome double,



the outer expanded and reflected, forming a conspicuous auricle at the posterior angle and adnate to the preceding turn on the parietal wall; the inner slightly exserted above the outer and also slightly reflected. Operculum thin, corneous, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

This species appears to range from the mouth of Yateras River in Oriente, west through the Guantanamo Bay shorelines. We are recognizing three subspecies.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMA*) *MARGINALBUM*

Denticles at the summit narrow and closely crowded..... *marginalbum*  
Denticles at the summit not narrow or closely crowded.

Sculpture coarse..... *guantanamense*  
Sculpture not coarse..... *subguantanamense*

*CHONDROPOMA* (*CHONDROPOMA*) *MARGINABLUM* *MARGINABLUM* (Gundlach) Pfeiffer

PLATE 31, FIGURE 2

1859. *Cyclostoma marginalbum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 6, pp. 75, 76.

This is the rose-colored race in which the axial riblets terminate as slender narrow, closely spaced denticles at the summit. The axial riblets are less strongly expressed and narrower than in the other two races. It comes from Caimanera.

The specimen figured, U.S.N.M. no. 493190, has about 4 whorls remaining and measures: Length, 18.0 mm; greater diameter, 9.9 mm; lesser diameter, 8.2 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *MARGINALBUM* *GUANTANAMENSE*, new subspecies

PLATE 31, FIGURE 1

This race occupies the lowland point on the west side of the entrance to Guantanamo Bay. It is a small race with very close sculpture, comparatively speaking, and with strong denticulations at the summit.

The type, U.S.N.M. no. 367784, has 3.3 whorls remaining and measures: Length, 14.0 mm; greater diameter, 8.2 mm; lesser diameter, 7.0 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *MARGINALBUM* *SUBGUANTANAMENSE*, new subspecies

PLATE 31, FIGURE 3

This is a small race that appears to extend over the shoreline of the eastern portion of Guantanamo Bay, being found on the various

digitations about the Naval Station. It is much smaller than the typical form and has even stronger, sharper denticulations at the summit than *C. (C.) marginalbum guantanamoense*. It varies considerably in color from the typical rose-colored forms to ashy gray.

The type, U.S.N.M. no. 493198, comes from the hill at the officers' quarters at the Naval Station. It has 4 whorls remaining and measures: Length, 15.2 mm; greater diameter, 8.0 mm; lesser diameter, 7.0 mm.

CHONDROPOMA (CHONDROPOMA) OXYTREMUM (Gundlach) Pfeiffer

PLATE 32, FIGURE 4

1860. *Cyclostoma (Chondropoma) oxytremum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 7, pp. 29-30.

Truncated shell elongate-ovate, buff with very faint interrupted spiral bands of brown. The dots composing these bands are usually arranged in both axial and spiral series. The whorls remaining are somewhat inflated, well rounded, narrowly shouldered at the summit, marked by threadlike, retractively slanting axial riblets, which are strongly developed at the summit, which they render conspicuously crenulate. The spiral sculpture consists of low, rounded threads, which are a little broader than the axial riblets. Of these, 12 are present on the last whorl between the summit and suture. The junctions of the axial riblets and the spiral threads form slender elongate nodules, which have their long axis parallel with the axial sculpture. The spaces enclosed between them are not conspicuously pitted. Suture narrowly channeled. Periphery well rounded. Base moderately long, slightly inflated, well rounded, marked by the continuations of the axial ribs and spiral threads, the latter a little weaker than those on the spire; the nodulation therefore also becomes somewhat weaker. There are two slender spiral threads within the narrow umbilicus. Aperture broadly oval; peristome simple, slightly expanded. The parietal lip is adnate to the preceding turn. Operculum thin, corneous, paucispiral, with submarginal nucleus, the outside covered with a thin deposit of fine calcareous granules.

The specimen described and figured, U.S.N.M. no. 493283, is the smallest of the lot of four obtained by Dr. Torre from Gundlach but is the most perfect. It was collected at Gibara. It has 3.5 whorls and measures: Length, 10.1 mm; greater diameter, 6.0 mm; lesser diameter, 5.5 mm.

Of the animal of this species Gundlach says, *loc. cit.* "On stones in the neighborhood of Gibara. Animal whitish with a roseate sheen particularly upon the head. Foot with white spots, snout with blackish dots. Tentacles ochre colored with darker or greyish tip. The

same color characterizes the base of the tentacles." The largest specimen has 3.5 whorls remaining and measures: Length, 12.3 mm; greater diameter, 7.2 mm; lesser diameter, 5.8 mm.

**CHONDROPOMA (CHONDROPOMA) APPENDICULATUM, new species**

Shell when perfect elongate-ovate, when truncated ovate, varying in ground color from flesh-color to pale buff, marked with interrupted spiral bands of brown whose elements are also arranged in axial series. Nuclear whorls 2, forming a subcylindric apex, strongly inflated and rounded, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls narrowly shouldered at the summit, marked on the early turns by very numerous, closely spaced, hairlike, retractively slanting riblets, which become broader as the shell advances in growth but are never very strongly pronounced. Several of them, however, may fuse at the summit, or they may singly expand into conspicuous white denticles. The spiral sculpture consists of low, poorly developed cords, which are not so wide as the spaces that separate them. The junctions of the axial ribs and spiral cords produce feeble nodules. The whole sculpture of the spire presents an obsolete effect. Periphery well rounded. Base rather long, well rounded and marked like the spire. The umbilical wall is also marked by spiral threads and the feeble continuation of the axial ribs. Aperture broadly ovate; peristome double, the outer and inner quite indistinct on the basal and outer lip, but separated by an impressed line on the inner lip and parietal wall. The two form a conspicuous auricle at the posterior angle. Operculum thin, paucispiral, with submarginal nucleus covered with a thin deposit of calcareous granules.

This species is found about Gibara, Oriente Province, where two races are present.

**KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) APPENDICULATUM**

Spiral threads of last whorl 14----- subappendiculatum  
Spiral threads of last whorl 17----- appendiculatum

**CHONDROPOMA (CHONDROPOMA) APPENDICULATUM APPENDICULATUM, new subspecies**

**PLATE 35, FIGURE 7**

This race, which was collected by Gonzales near Gibara, is the larger of the two races and has the sculpture much less strongly developed than the smaller race. It is also somewhat paler, with the interrupted spiral lines more conspicuous.

The type, U.S.N.M. no. 468978, has 3.3 whorls and measures: Length, 16.4 mm; greater diameter, 10.1 mm; lesser diameter, 7.8 mm.

**CHONDROPOMA (CHONDROPOMA) APPENDICULATUM SUBAPPENDICULATUM,**  
new subspecies

## PLATE 35, FIGURE 8

This subspecies was collected by Allen about Gibara, without definite locality. It is smaller and darker colored than the typical race and has stronger sculpture.

The type, U.S.N.M. no. 468979, has 5.5 whorls remaining and measures: Length, 14.8 mm; greater diameter, 7.8 mm; lesser diameter, 6.7 mm.

**CHONDROPOMA (CHONDROPOMA) LAETUM (Gutierrez) Poey**

## PLATE 35, FIGURE 2

1858. *Cyclostoma lactum* (GUTIERREZ) POEY, *Memorias sobre historia natural de la Isla de Cuba*, pp. 33-34, pl. 4, fig. 1.

Truncated shell elongate-ovate. Early whorls decollated in all our specimens. Those remaining flesh-color, with interrupted spiral bands of pale brown. The dots composing these bands are arranged in both axial and spiral series. The whorls are inflated, narrowly shouldered, the shoulder marked by slender, rather regularly disposed denticles. The rest of the whorls are marked by retractively slanting axial threads, which are a little stronger on the early turns than on the rest. The spiral sculpture consists of rather distantly spaced, conspicuous, slender cords, of which 8 are present on the first of the remaining turns, 11 on the second and 12 on the last between the summit and suture. The junctions of the axial threads and spiral cords form slender nodules, which are materially reduced on the last turn, which bears a mere indication of them. Suture narrowly channeled. Periphery of the last whorl inflated, well rounded. Base short, inflated, well rounded, and marked by spiral cords of the same strength and spacing as those on the posterior half of the whorl. Within the umbilicus, however, they become less conspicuous. Aperture large, very oblique, broadly oval, rather strongly auriculated at the posterior angle; peristome double, the outer and inner coextensive on the outer lip, and but slightly differentiated at the posterior angle, on the parietal wall and on the inner lip.

The specimen described and figured, U.S.N.M. no. 493287, was collected by Dr. de la Torre at Gibara, Oriente Province. It has a little more than 3 whorls remaining and measures: Length, 12.0 mm; greater diameter, 6.9 mm; lesser diameter, 6.0 mm.

**CHONDROPOMA (CHONDROPOMA) EDOUARDI Aguayo**

Shell of medium size, when truncated elongate-ovate, buff with interrupted spiral bands of brown. The elements composing these

bands are also arranged in axial series. They are present on both spire and base. Nuclear whorls decollated; postnuclear whorls well rounded, narrowly shouldered at the summit, and crossed by numerous, somewhat wavy, slender axial riblets, which are about as wide as the spaces that separate them. These riblets render the summit of the whorls very finely serrulated. Suture very narrowly channeled; periphery inflated, strongly rounded. Base moderately long, openly umbilicate, marked like the spire. The umbilical wall, however, and the region adjacent to it are marked by stronger spiral threads. Aperture ovate, auriculated posteriorly. Peristome simple, slightly expanded and reflected. The last turn is solute for about one-tenth of a whorl. Operculum thin, corneous, paucispiral, with submarginal nucleus.

We are recognizing two subspecies.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMA*) *EDOUARDI*

Junctions of the axial and spiral threads forming sharp cusps----- *asperulum*  
Junctions of the axial and spiral threads not forming sharp cusps---- *edouardi*

*CHONDROPOMA* (*CHONDROPOMA*) *EDOUARDI* *EDOUARDI* Aguayo

PLATE 35, FIGURE 1

1934. *Chondropoma edouardi* AGUAYO, Mem. Soc. Poey, vol. 8, pp. 90-91, fig. 1.

This race, which was described by Aguayo from Loma de Canada de Jagüeyes, Holguin, differs from *C. (C.) edouardi asperulum* in the junctions of the axial riblets and spiral threads forming only feeble denticulations.

The specimen described and figured, U.S.N.M. no. 425501, which was received from Aguayo, has almost 4 whorls remaining and measures: Length, 14.1 mm; greater diameter, 8.4 mm; lesser diameter, 6.8 mm.

*CHONDROPOMA* (*CHONDROPOMA*) *EDOUARDI ASPERULUM* Aguayo

PLATE 35, FIGURE 3

1934. *Chondropoma laetum asperulum* AGUAYO, Mem. Soc. Poey, vol. 8, pp. 89-90, fig. 2.

This subspecies, also collected by Aguayo, comes from the Cerro Colorado near Gibara. It is distinguished from *C. (C.) edouardi edouardi* by having the junctions of the axial riblets and spiral threads much more strongly cusped; hence the name *asperulum*.

The specimen described and figured, U.S.N.M. no. 425503, received from Aguayo, has almost 4 whorls remaining and measures: Length 14.9 mm; greater diameter, 9.2 mm; lesser diameter, 7.0 mm.

## CHONDROPOMODES, new subgenus

In this subgenus the shell is of ovate shape. The axial sculpture consists of exceedingly slender, rather closely spaced, sublamellar riblets, which are rendered sinuate by the slender spiral threads, the combination producing a vertebrated aspect. These riblets are gathered into tufts at the summit as in *Chondropomorus*.

Type: *Chondropoma* (*Chondropomodes*) *santaluciense*, new species.

## KEY TO THE SPECIES OF SUBGENUS CHONDROPOMODES

Outer peristome broadly expanded..... *ernesti*  
Outer peristome not broadly expanded..... *santaluciense*

## CHONDROPOMA (CHONDROPOMODES) SANTALUCIENSE, new species

## PLATE 35, FIGURE 5

Shell elongate-ovate, when truncated ovate, pale buff with interrupted spiral bands of brown. The dots composing these are very distantly spaced and arranged also in axial series. On the inner lip they are present, forming more or less confluent lines. Nuclear whorls a little more than 2, well rounded, smooth; postnuclear whorls well rounded, narrowly shouldered at the summit and marked by slender, closely spaced, sublamellar axial riblets and feeble spiral threads, which form, at the junction with the riblets, fine rounded tubercles and give to the riblets a somewhat vertebrated appearance. These riblets become fused at the summit of the whorls, where they form firm sharp white denticles. Suture channeled. Periphery of the last whorl well rounded. Base short, well rounded, and marked like the spire but with the spiral threads becoming a little stronger toward the open umbilicus whose parietal wall is marked by still stronger spiral threads and the continuation of the axial riblets. Aperture very broadly ovate; peristome double, forming a conspicuous auricle at the posterior angle. The outer peristome reflected and expanded; the inner also reflected and adnate to the outer, but not quite reaching its margin. On the auricles at the posterior angle there is a series of small lamellae indicating, evidently, a resting stage growth of these elements. The last whorl is slightly solute. Operculum thin, corneous, paucispiral, with marginal nucleus.

The type, U.S.N.M. no. 468980, comes from the Portales Camayuín, Arroyo Blanco, Santa Lucia, Oriente. It has 3.4 whorls remaining and measures: Length, 12.1 mm; greater diameter, 9.5 mm; lesser diameter, 7.3 mm.

This species can be readily distinguished from *Chondropoma* (*Chondropomodes*) *ernesti* Pfeiffer by its having a much less expanded outer peristome.

## CHONDROPOMA (CHONDROPOMODES) ERNESTI Pfeiffer

Shell of medium size, flesh-color, with weak interrupted spiral bands of brown, which are present on spire and base. The spiral bands show as brown zones on the outer peristome; the plug at the decollated apex also shows through the substance of the shell as a dark-brown zone. Nuclear whorls a little more than 2, strongly rounded, smooth. Postnuclear whorls well rounded, narrowly shouldered at the summit, marked by very narrow, retractively curved axial riblets, which are rather closely spaced on the early whorls and much more so on the later. These riblets extend prominently to the summit, where they may fuse into tufts, which they render conspicuously crenulate. In addition to the axial riblets, the whorls are marked by spiral threads of about the same strength as the axial riblets; the junctions of these form slender nodules, while the spaces enclosed by them are rectangular, having their long axis parallel with the axial sculpture. Suture almost channeled. Periphery of the last whorl strongly rounded. Base inflated, strongly rounded, narrowly openly umbilicated, marked by the continuations of the axial riblets and the spiral threads, which are about as strong as those on the spire. Umbilicus marked by the continuations of the axial riblets and 8 spiral threads which are of almost equal strength. Aperture broadly oval; peristome double, the inner thickened at the edge and slightly reflected, the outer broadly expanded and reflected, not flatly but in a wavy oblique manner; the outer peristome forms a conspicuous auricle at the posterior angle; that of the parietal wall being appressed to the preceding turn, while that of the inner lip is reflected over and covers about two-thirds of the umbilicus; operculum paucispiral with subcentral nucleus.

Of this species Gundlach<sup>12</sup> states "Animal pale or whitish, only the head and neck somewhat brownish on account of the thicker mass of flesh. The head and neck are somewhat reddish within. Head and snout with dark markings which form almost regular interrupted lines. Tentacles gray, especially so at their tip. Eye ring whitish. The first whorl of the shell lets the animal shine through greenish, which is due to the color of the intestines. This species also suspends itself with a mucous thread when at rest."

We are recognizing two subspecies.

## KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMODES) ERNESTI

Axial ribs distantly spaced.....	clenchi
Axial ribs not distantly spaced.....	ernesti

<sup>12</sup> Malakozool. Blätter, vol. 9, p. 5, 1862.

## CHONDROPOMA (CHONDROPOMODES) ERNESTI ERNESTI Pfeiffer

## PLATE 35, FIGURE 4

1862. *Chondropoma ernesti* PFEIFFER Malakozool. Blätter, vol. 9, p. 5.

The typical subspecies was collected by Jeanneret at Seboruco, south of Mayari.

The specimen that we have figured, U.S.N.M. no. 367804, is one received by Dr. de la Torre from Jeanneret. It has a little more than 4 whorls remaining and measures: Length, 14.4 mm; greater diameter, 8.9 mm; lesser diameter, 7.0 mm.

It is easily distinguished from *C. (C.) ernesti clenchi* by having the axial riblets and spiral threads more closely spaced.

## CHONDROPOMA (CHONDROPOMODES) ERNESTI CLENCHI Aguayo

## PLATE 35, FIGURE 6

1932. *Chondropoma ernesti clenchi* AGUAYO, Occ. Pap. Boston Soc. Nat. Hist., vol. 8, p. 33, pl. 3, fig. d.

This subspecies was collected by Aguayo at Las Cuevas, Holguin, Oriente. It differs from the typical *C. (C.) ernesti ernesti* in being more inflated, that is, more broadly ovate, and in having both the axial and spiral sculpture more distantly spaced and the outer peristome more broadly expanded.

The specimen described and figured is a holotype and is located in the Museum of Comparative Zoölogy at Cambridge, Mass., where it is listed as no. 47999.

## Subgenus CHONDROPOMORUS Henderson and Bartsch

1920. *Chondropomorus* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 61.

Shell elongate-conic; marked by both axial and spiral threads, the axial threads being gathered into tufts at the summits of the whorls.

Type: *Cyclostoma dentatum* Say.

## KEY TO THE SPECIES OF SUBGENUS CHONDROPOMORUS

Peristome simple.

Tufts at summit very regular..... revinctum

Tufts at summit irregular..... auberianum

Peristome double.

Outer peristome of inner lip broadly expanded.

Sculpture coarse and irregular..... delatreanum

Sculpture fine and regular..... neglectum

Outer peristome of inner lip not broadly expanded.

Peristome auriculate at posterior angle..... dilatatum

Peristome not auriculate at posterior angle..... canescens



## CHONDROPOMA (CHONDROPOMORUS) REVINCTUM (Poey)

1851. *Cyclostoma revinctum* POEY, Memorias sobre historia natural de la Isla de Cuba, vol. 1, pp. 99, 106, pl. 5. figs. 24-27.

Shell elongate-conic, flesh-color, with various marblings, blotchings, spottings, and streakings of brown; but no matter what the superimposed color markings may be, there are always a number of interrupted spiral bands of dark brown, both on the spire and base, whose elements are arranged in both axial and spiral series. Aperture pale brown, showing the spiral bands within which extend over the peristome. Nuclear whorls 1.5, inflated, smooth, forming a truncated apex with the sutural line of the first whorl, chestnut-brown. Postnuclear whorls marked by retractively slanting axial riblets, which are low and only moderately strongly developed and which are gathered together into short and rather broad tufts at the summit at more or less regular intervals. The spiral sculpture consists of threads about as strong as the axial riblets, which are also not strongly elevated, the two forming a screenlike sculptural pattern. The junctions of the axial ribs and the spiral threads form scarcely perceptible nodules, while the spaces enclosed between them are squarish pits. Suture moderately constricted. Periphery with a feeble angulation. Base moderately long, well rounded, moderately broadly umbilicated, marked by the continuation of the axial riblets and spiral threads, which increase in size from the periphery toward the umbilicus, those within the umbilical wall being a little stronger than those immediately outside. Aperture broadly oval; peristome simple. Operculum paucispiral with submarginal nucleus, the outer surface covered with a fine thin granular calcareous deposit.

Of the animal of *Chondropoma* (*Chondropomorus*) *revinctum revinctum* Bartsch's field notes state:

"Animal pale gray with olivaceous tinge; dorsal part covered with ever so many tiny white dots. There is a pink area behind the tentacles. Tentacles faintly tinged with orange a little above the base, which is the general body color, the expanded tip dusky. Sides of body pale olivaceous. Sole of foot deeply cleft, a little more yellowish than the sides. Abundant on trees and in the rubbish at their base."

Of *Chondropoma* (*Chondropomorus*) *revinctum biserranum* he says:

"Animal smoky gray with greenish tinge, pinkish about the edges. Sole of foot a little paler, deeply cleft."

This species ranges from the coast at Punta San Juan de los Perros and Punta Alegre inland to the Dos Sierras near Zulueta, Santa Clara Province. We are recognizing two subspecies.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMORUS*) *REVINCTUM*

Shell moderately slender and of light color----- *revinctum*  
Shell moderately stout and of darker color----- *biserratum*

*CHONDROPOMA* (*CHONDROPOMORUS*) *REVINCTUM BISERRANUM*, new subspecies

PLATE 33, FIGURE 6

This subspecies, which comes from the mogotes of the Dos Sierras a little east of Zulueta, Santa Clara Province, differs from the typical form in being much darker, the interrupted spiral bands, particularly those near the suture, being spread out into blotches almost forming fulgurations. The whorls are also more inflated and the denticles are more pronounced.

The type, U.S.N.M. no. 499681, was collected by Bartsch on the mogote east of the gap of the Dos Sierras. It is a perfect specimen of 7.5 whorls and measures: Length, 16.2 mm; greater diameter, 7.8 mm; lesser diameter, 6.2 mm.

*CHONDROPOMA* (*CHONDROPOMORUS*) *REVINCTUM REVINCTUM* (Poey)

PLATE 33, FIGURE 4

1851. *Cyclostoma revinctum* POEY, *Memorias sobre historia natural de la Isla de Cuba*, vol. 1, pp. 99, 106, pl. 5, figs 24-27

This race was first described from Punta San Juan de los Perros, Camaguey Province. Bartsch has also collected it on the paradones about Punta Alegre. This race is paler than the next and a little slenderer, with the whorls a little less convex and the denticles less pronounced.

The specimen figured, U.S.N.M. no. 388761, comes from Punta de los Perros. It is a perfect specimen of 8 whorls and measures: Length, 16.7 mm; greater diameter, 7.5 mm; lesser diameter, 5.8 mm.

*CHONDROPOMA* (*CHONDROPOMORUS*) *CANESCENS* Pfeiffer

Shell elongate-conic; the color pattern varies materially, sometimes even in the same locality, although as a rule there is a comparatively uniform aspect to it in the same locality. The shell may be flesh-color, or flesh-color with a brownish tinge. In all shells, even those that are more or less unicolor on the later turns, the early whorls have at least an indication of usually four interrupted spiral bands of brown. These frequently are reduced to mere dots; but whether almost continuous or mere dots, their arrangement is in both axial and spiral series. Frequently there are cloudings to the ground color, and even more frequently there are axial bands of brown or dark brown comma-shaped areas pending from the summit, and other blotches below it; or the shell may be vermiculated, flammulated, or ful-

gured. There is usually a subperipheral dark spiral zone a little more pronounced than those on the spire. The rest of the base is marked like the spire. The inside of the aperture varies from flesh-color to brown. In one race there is a dark reddish-brown band immediately within the outer lip on the inner peristome; the outer edge of the inner peristome is usually paler and shows the spiral bands of brown more or less conspicuously, depending upon the development of this element. Nuclear whorls 2, inflated, strongly rounded, forming a blunt apex. Suture with a conspicuous brown zone. Post-nuclear whorls well rounded, marked by axial ribs which vary considerably in strength. At more or less regular intervals these riblets are gathered into tufts at the summit, which likewise vary in strength from broad coarse denticles to slender, short toothlike elements. The spiral sculpture is as variable as the axial, and usually varies with it; that is, when the axial sculpture is feeble, the spiral is likewise so; when the axial sculpture is strong, the spiral is likewise. Suture well constricted. Periphery well rounded. Base moderately long, well rounded, narrowly openly umbilicate, the widths of the umbilicus being rather constant for the race in question, marked by the continuation of the axial riblets and spiral threads. Aperture oval; peristome double; the outer of variable width, sometimes scarcely extending beyond the inner, at others rather conspicuously expanded. These characters appear to be constant in the different races. The outer peristome is more or less scalloped at the edge, and this scalloping varies in extent; in some races it extends over the major portion of the outer and basal lip, and even the anterior portion of the inner lip; while in others it may be restricted to the angle of the inner and basal lip; the outer peristome is a little more expanded as a rule at the posterior angle, but it does not form a conspicuous auricle at this place; the outer peristome may be fused with the preceding whorl at the parietal wall; it may be appressed to it or entirely free from it. In some of the races this character appears to be constant, while in others it varies from one extreme to another. The inner peristome is also expanded, but less so than the outer, and slightly reflected, usually a little broader on the outer lip than the inner or parietal. Operculum paucispiral with submarginal nucleus, the outer surface covered with a fine thin granular calcareous deposit.

Dr. de la Torre has examined Pfeiffer's type of this species in the British Museum and based the following notes thereon:

"A worn specimen without operculum, very elongate, nearly entire, partly calcined, but it is possible to see that it belonged to the orange or reddish colored variety. It measures: Length, 20.0 mm; diameter, 7.0 mm; aperture length, 5.0 mm; diameter, 4.0 mm. The label states that it was received from Cumings."

Pfeiffer cites Gibara, Nuevitas, and Holguin. Of these three localities the specimens from Nuevitas satisfy Pfeiffer's description best. They also correspond with the type in size and color. We shall, therefore, consider the Nuevitas race the typical one.

The species ranges from Turiguano Island through the Cubitas Mountains eastward to Sagua de Tanamo, breaking up into a series of races described below.

KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMORUS) CANESCENS

- Adult shell with a dark axial zone immediately within peristome  
of outer lip----- *alleni*  
Adult shell without a dark axial zone immediately within peristome  
of outer lip.  
Shell comparatively slender----- *nipense*  
Shell not comparatively slender.  
Truncated shell short and stout----- *perplexum*  
Truncated shell rather long and less stout----- *canescens*

CHONDROPOMA (CHONDROPOMORUS) CANESCENS CANESCENS Pfeiffer

PLATE 33, FIGURE 8

1851. *Chondropoma canescens* PFEIFFER, Proc. Zool. Soc. London, 1851, p. 245.  
1851. *Cyclostoma confertum* POEY, Memorias sobre historia natural de la Isla de Cuba, vol. 1, pp. 99, 106, pl. 8, figs. 1-3.

This subspecies we restrict to the race occupying Nuevitas and the Cubitas Mountain region as well as the mogotes adjacent to these. The truncated shell is rather long, and the whorls are inflated. The sculpture is strong; the outer peristome is rather broadly expanded. It differs chiefly from *C. (C.) canescens perplexum* in being more elongate.

The specimen figured, U.S.N.M. no. 355068, comes from Loma de Borje, Camaguey Province. It has 5.8 whorls remaining and measures: Length, 17.2 mm; greater diameter, 8.5 mm; lesser diameter, 6.8 mm.

CHONDROPOMA (CHONDROPOMORUS) CANESCENS PERPLEXUM, new subspecies

PLATE 33, FIGURE 7

This race occupies the region about Gibara and Holguin.

It most nearly resembles the typical race, *C. (C.) canescens canescens* but differs from it in the truncated shell being shorter and in being a little more heavily denticulated at the summit, with the outer peristome a little less strongly expanded.

The type, U.S.N.M. no. 355062, comes from Holguin. It has almost 5 whorls remaining and measures: Length, 14.2 mm; greater diameter, 7.0 mm; lesser diameter, 5.9 mm.

**CHONDROPOMA (CHONDROPOMORUS) CANESCENS NIPENSE, new subspecies**

## PLATE 33, FIGURE 9

This race comes from the region about Nipe Bay, Felton, Antilla and Cayo del Rey. It is readily distinguished from the rest in being much slenderer and with the whorls less inflated.

The type, U.S.N.M. no. 355085, comes from Felton. It has 5.8 whorls remaining and measures: Length, 15.1 mm; greater diameter, 7.0 mm; lesser diameter, 5.6 mm.

**CHONDROPOMA (CHONDROPOMORUS) CANESCENS ALLENI, new subspecies**

## PLATE 33, FIGURE 5

This race comes from the region about Sagua de Tanamo. In many ways this shell resembles *C. (C.) canescens perplexum*, but the adult shells, however, are very readily distinguished from it by the dark chestnut-brown axial zone on the inside of the outer lip immediately within the peristome.

The type, U.S.N.M. no. 367774, has 5.3 whorls remaining and measures: Length, 14.4 mm; greater diameter, 6.8 mm; lesser diameter, 5.7 mm.

**CHONDROPOMA (CHONDROPOMORUS) NEGLECTUM (Gundlach) Pfeiffer**

## PLATE 34, FIGURE 5

1856. *Cyclostoma neglectum* POEY, Memorias sobre historia natural de la Isla de Cuba, p. 4, *nomen nudum*.  
1858. *Cyclostoma neglectum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 5, pp. 46-47.  
1858. *Chondropoma revinctum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 137.

Shell very elongate-conic, of horn-color ground color, with interrupted bands of brown having both an axial and spiral arrangement. The long axis of the dark streaks is parallel with the spiral sculpture. In addition to this, the ribs are flesh-color in irregular blotches. The inner peristome is pale brown at its outer margin, while the outer shows the dark spiral bands. There is also a very dark brown band encircling the top of the nuclear turns. Nuclear whorls 2, rather large, forming a blunt apex; the first 1.5 well rounded, smooth, the last half with fine axial threads. There is an oblique band of brown at the termination of the nuclear turns, marking a septum or place for disjunction. Postnuclear whorls almost inflated, strongly rounded, marked by threadlike, somewhat retractively curved, axial riblets, which at more or less irregular intervals become strengthened at the summit where several of them frequently fuse to form a tooth-like projection, which is appressed to the preceding turn. In addition to the axial sculpture the whorls are marked by spiral threads, which

are equal to the axial riblets in strength. The junction of these two elements forms slender nodules, while the spaces enclosed between them form squarish pits. Suture rendered conspicuously crenulated by the toothlike projection at the summit. Periphery well rounded. Base moderately long, well rounded, moderately, broadly umbilicate, marked by the continuation of the axial riblets and spiral threads, which are a little stronger than those on the spire. The umbilical wall is marked by five rather strong spiral cords as well as the feeble continuation of the axial riblets. Aperture oval; peristome double all around; outer peristome expanded obliquely all around, a trifle narrower on the columellar wall; inner peristome also expanded and reflected; at the posterior angle there is a slight auriculation, and here several lamellae are present between the inner and outer peristome. Operculum thin, paucispiral with the nucleus intermediate between subcentral and marginal, the major portion covered with a thin, finely granular deposit.

The specimen described and figured, U.S.N.M. no. 493256, is one received from Dr. de la Torre and collected by Cisneros at Cabo Cruz, Oriente Province. This has 7.6 whorls and measures: Length, 15.0 mm; greater diameter, 6.8 mm; lesser diameter, 5.4 mm.

The species ranges along the south coast from Ojo de Agua to Manzanillo.

**CHONDROPOMA (CHONDROPOMORUS) DILATATUM (Gundlach) Pfeiffer**

Shell elongate-conic, with the ground color flesh-color or horn color, marked by interrupted spiral bands of brown, which vary from inconspicuous to very decided chestnut brown in color, and which also vary very materially in width; peristome whitish, rayed with brown; the interior of the aperture varies with the coloration of the outside; there is also a brown line following the suture on the apex of the shell. Nuclear whorls almost 2, well rounded, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly rounded, marked by very slender, poorly developed, retractively slanting axial riblets; of these, at quite regular intervals, several become fused at the summit to form conspicuous denticles. The strength of these denticles varies materially in the different races. The spiral sculpture consists of quite closely spaced threads, which in some of the races are of about the same strength as the axial riblets, while in others they are weaker; the junctions of the axial riblets and the spiral threads scarcely form nodules, while the spaces enclosed between them are moderately well impressed pits. Suture well constricted. Periphery subangulate. Base short, well rounded, openly

umbilicated, marked by the continuation of the axial riblets and the spiral threads equaling those of the spire on the last turn in strength and spacing; immediately within the umbilicus there are several stronger spiral threads. Aperture very broadly oval; peristome double, the outer slightly expanded and slightly reflected, denticulate at the junction of the inner and basal lip; the inner moderately exerted and also reflected and almost fused with the outer. Operculum very thin with the nucleus halfway between marginal and central, the inner half of the last whorl covered with a very thin coat of calcareous granules.

This species is confined to eastern Cuba where it breaks up into a number of subspecies here described.

Of the typical race Gundlach says: "On trees. Animal brownish white, on the head (between the antennae), and on the rump gray. Neck clay yellow; antennae bright brown with white apex. The region about the eye white."

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMORUS*) *DILATATUM*

Greater diameter more than 8.5 mm..... *toroense*  
Greater diameter less than 8.0 mm.

Sculpture rather coarse..... *pilotense*

Sculpture fine.

Denticles at the summit fine and closely spaced.

Interrupted spiral bands of brown broad..... *bayatense*

Interrupted spiral bands of brown narrow..... *dilatatum*

Denticles at summit not fine or closely spaced..... *subdilatatum*

*CHONDROPOMA* (*CHONDROPOMORUS*) *DILATATUM* *DILATATUM* (Gundlach) Pfeiffer

PLATE 34, FIGURE 9

1859. *Cyclostoma dilatatum* (GUNDLACH) PFEIFFER, Malakazool. Blätter, vol. 6, p. 75.

This race, which originally was collected by Gundlach along the River Yateras, by Wright at Monte Verde, and by Henderson and Bartsch on the shoulder of Monte Libano near the Guaso River, has the whorls moderately inflated and finely denticulated at the summit. The interrupted spiral bands are, comparatively speaking, narrow, the surface is blotched with white areas suggesting a watered silk aspect.

The specimen described and figured, U.S.N.M. no. 493258, is one of two collected by Gundlach at Yateras. It has 8.0 whorls remaining and measures: Length, 16.6 mm; greater diameter, 7.6 mm; lesser diameter, 6.1 mm.

Of the subspecies here described it most nearly resembles *C. (C.) dilatatum bayatense*, from which it can be distinguished easily by its larger size and narrower interrupted spiral bands.

**CHONDROPOMA (CHONDROPOMORUS) DILATATUM TOROENSE, new subspecies**

## PLATE 34, FIGURE 7

This race comes from San Felipe, Lechuza, Monte Toro. It is the largest of the known races and has the elements constituting the interrupted spiral bands so much widened that they almost fuse axially, forming conspicuous axial dark bands.

The type, U.S.N.M. no. 367766, has 5.6 whorls remaining and measures: Length, 16.8 mm; greater diameter, 8.6 mm; lesser diameter, 7.0 mm.

**CHONDROPOMA (CHONDROPOMORUS) DILATATUM BAYATENSE, new subspecies**

## PLATE 34, FIGURE 6

This race was collected by Dr. Ramsden at Bayate, west of Monte Toro. It is a small race resembling in the character of the sculpture the typical *C. (C.) dilatatum* but differing from it in having the spiral bands, comparatively speaking, much broader, in which respect it stands about halfway between *C. (C.) dilatatum dilatatum* and *C. (C.) d. toroense*.

The type, U.S.N.M. no. 367768, has 5.5 whorls remaining and measures: Length, 11.9 mm; greater diameter, 6.1 mm; lesser diameter, 5.0 mm.

**CHONDROPOMA (CHONDROPOMORUS) DILATATUM PILOTENSE, new subspecies**

## PLATE 34, FIGURE 4

This subspecies comes from Pilote, Arriba, Mayari. It differs from all the others by having both the axial and spiral sculpture much coarser and more netlike with the denticles at the summit much heavier.

The type, U.S.N.M. no. 367767, is a complete specimen of seven whorls and measures: Length, 13.2 mm; greater diameter, 6.4 mm; lesser diameter, 5.5 mm.

**CHONDROPOMA (CHONDROPOMORUS) DILATATUM SUBDILATATUM, new subspecies**

## PLATE 34, FIGURE 8

The type of this race comes from Guajenal, Sagua de Tanamo. We also have it from El Coco, Sagua de Tanamo.

It differs from typical *C. (C.) dilatatum dilatatum*, with which it agrees in size, in having both the axial and spiral sculpture coarser but not so coarse as in *C. (C.) dilatatum pilotense*. The denticles at the summit, too, stand about half way between these two forms, while the outer peristome is much more expanded than in any of the others.



The type, U.S.N.M. no. 367764, has 6.0 whorls remaining and measures: Length, 16.1 mm; greater diameter, 6.8 mm; lesser diameter, 5.5 mm.

**CHONDROPOMA (CHONDROPOMORUS) DELATREANUM (Orbigny)**

Shell elongate-conic; all our specimens truncated; ground color ranging from flesh-color to pale brown; darker brown spiral bands are present, which are usually interrupted and the elements constituting them are arranged in both axial and spiral series. At times, however, they are continuous, but even then there is more or less of an axial and spiral emphasis in the color pattern. At times the outer edge of the axial ribs is white, which forms, in addition to the color scheme mentioned above, a blotchy appearance. The peristome is rarely ever marked by strong alternating bands of dark and light; as a rule it is unicolor. Postnuclear whorls moderately strongly arched, marked by retractively slanting axial riblets, which are slightly sinuous and which are at irregular intervals gathered into tufts or strong denticles at the summit. In addition to this, spiral threads are present, which are a little wider than or as wide as the axial ribs. The junctions of the ribs and the spiral threads form slender nodules, while the spaces enclosed between them form more or less rectangular or squarish pits. Suture moderately constricted. Base moderately long, narrowly openly umbilicated, marked by the continuation of the axial ribs and spiral threads, the latter a little broader and more closely spaced than those on the spire. The umbilical wall is marked by rather conspicuous spiral threads. The last whorl is solute for a small fraction of a turn. Aperture oval; peristome double, both the inner and outer moderately expanded and reflected, the outer extends a little less beyond the inner on the columellar wall and forms a slight auricle at the posterior angle; the inner projects considerably above the outer. Operculum thin, with the nucleus midway between subcentral and marginal, covered with a fine, thin granular deposit.

The races of this species are distributed through Santa Clara Province.

**KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMORUS) DELATREANUM**

Length of decollated shell more than 13 mm..... *santafeum*

Length of decollated shell less than 12 mm.

    Last whorl conspicuously solute..... *bonacheum*

    Last whorl not conspicuously solute..... *delatreanum*

**CHONDROPOMA (CHONDROPOMORUS) DELATREANUM SANTAFEUM, new subspecies**

**PLATE 33, FIGURE 2**

This race, which is larger than the others, comes from the region about Loma de Santa Fe, Santa Clara Province. The sculpture is

much stronger than in the other races. The color markings on the peristome also extend more prominently over the outer lip.

The type, U.S.N.M. no. 493277, was collected by John B. Henderson at Loma de Santa Fe. It has a little more than 5 whorls remaining and measures: Length, 13.9 mm; greater diameter, 6.1 mm; lesser diameter, 5.2 mm.

**CHONDROPOMA (CHONDROPOMORUS) DELATREANUM BONACHEUM, new subspecies**

PLATE 33, FIGURE 1

This is the other small race that has the sculpture stronger than the typical *C. (C.) delatreanum delatreanum* and the denticles at the summit stronger and more distantly spaced. The last whorl is also much more solute.

The type, U.S.N.M. no. 493279, comes from Loma de Bonachea, a limestone hill on the north side of the road leading from Santa Clara to Remedios, 5 or 6 miles from Santa Clara. It has 4 whorls remaining and measures: Length, 11.1 mm; greater diameter, 5.8 mm; lesser diameter, 4.5 mm.

**CHONDROPOMA (CHONDROPOMORUS) DELATREANUM DELATREANUM (Orbigny)**

PLATE 33, FIGURE 3

1841. *Cyclostoma delatreana* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'Ile de Cuba*, vol. 1, pp. 262-263.

1845. *Cyclostoma dutertreana* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'Ile de Cuba*, vol. 1, pl. 22, figs. 18-20.

This race occupies the region about Soledad and Trinidad, Santa Clara Province. It is one of the two small races with the sculpture less strongly developed than in the others. It usually has a somewhat oily appearance and the denticles average finer than in the other small race, *C. (C.) delatreanum bonacheum*, from which it also differs by having the last whorl less solute.

The specimen described and figured, U.S.N.M. no. 493267, comes from near Guanao, 5 miles east of Cienfuegos. It has a little more than 5 whorls remaining and measures: Length, 11.1 mm; greater diameter, 5.4 mm; lesser diameter, 4.2 mm.

**CHONDROPOMA (CHONDROPOMORUS) AUBERIANUM (Orbigny)**

Shell elongate-conic, pale brown, marked by narrow elongated brown spots, which form almost continuous spiral bands. Nuclear whorls 2, inflated, forming a truncated apex, the first very finely granulose, the last half of the last with fine indistinct axial threads. Postnuclear whorls well rounded, marked by well-elevated, retrac-

tively slanting axial threads. A number of these threads are gathered together at the summit at more or less regular intervals into broad, large tufts or denticles. The spiral sculpture consists of threads a little stronger than the axial but much more distantly spaced. The junctions of the axial and spiral threads form feeble nodules, while the spaces enclosed between them form rectangular pits having their long axis parallel with the axial sculpture. Suture moderately constricted. Periphery of the last whorl well rounded. Base moderately long, well rounded, narrowly umbilicated, marked by the continuation of the axial ribs and spiral threads, the latter a trifle stronger than those on the spire. Several spiral threads are present on the parietal wall within the umbilicus. Last whorl slightly solute. Aperture broadly oval; slightly angulated at the posterior angle; peristome single, though in some of the specimens there is the merest indication of doubling at the posterior angle. This, however, may be altogether due to the denticles being well developed at that place at times. Operculum thin, paucispiral, with a thin, finely granular deposit on the outside. Nucleus submarginal.

Pfeiffer describes the animal as ashy gray. Eyes very distant, black, placed upon the white conic antennae. Foot very short posteriorly.

This is a lowland species that ranges from Matanzas Province west to Esperanza and southward to the south coast. *C. (C.) auberianum* has been confused with *C. (C.) dentatum*, which comes from the Florida Keys and which we consider a distinct species.

We are recognizing two subspecies.

#### KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMORUS*) *AUBERIANUM*

Axial and spiral sculpture prominent..... *auberianum*  
 Axial and spiral sculpture not prominent..... *mayense*

#### *CHONDROPOMA* (*CHONDROPOMORUS*) *AUBERIANUM AUBERIANUM* (Orbigny)

#### PLATE 34, FIGURES 1, 3

1839. *Cyclostoma lineolatum* ANTON, Verzeichniss der Conchylien, p. 54; not *Cyclostoma lineolatum* Lamarck, Histoire naturelle des animaux sans vertébrés, vol. 6, pt. 2, p. 147, 1822.
1839. *Cyclostoma crenulatum* PFEIFFER, Wiegmann's Archiv für Naturg., vol. 1, p. 356; not *Cyclostoma crenulatum* (Férussac) Potiez and Michaud, Galerie des mollusques . . . Douai, vol. 1, p. 235, pl. 24, figs. 3, 4, 1838.
1842. *Cyclostoma auberianum* ORBIGNY, in Sagra's Histoire physique, politique et naturelle de l'île de Cuba, vol. 1, p. 260, pl. 22, figs. 12-14.
1850. *Licina lunulatum* MÜLLER, in Mörch's Catalogus conchyliorum quae reliquit C. P. Kierulff, p. 8.
1876. *Chondropoma cisnerosi* ARANGO, Ann. Real Acad. Cienc. Habana, 1876, p. 1.

This very widely distributed race is easily distinguished from *C. (C.) auberianum mayense* by its larger size and weaker sculpture. The unworn shells always have a shining semivarnished aspect, which is absent from both *C. (C.) auberianum mayense* and *C. (C.) dentatum*.

The specimen figured, U.S.N.M. no. 493204, is one of four collected by Gundlach at Habana. It has 4 whorls remaining and measures: Length, 13.2 mm; greater diameter, 6.5 mm; lesser diameter, 5.6 mm.

A summary of the measurements of 100 specimens from various localities yields the following data:

	Number of whorls	Length	Greater diameter	Lesser diameter
		<i>Mm</i>	<i>Mm</i>	<i>Mm</i>
Greatest.....	6.9.....	15.8	7.7	6.3
Least.....	4+ (tip broken).....	7.2	4.5	3.6
Average.....	4+ (tip broken).....	12.2	6.2	5.2

*Chondropoma cisnerosi* Arango was based upon a pathologic specimen, the obsolete keeling of which was due to an injury.

#### CHONDROPOMA (CHONDROPOMORUS) AUBERIANUM MAYENSE, new subspecies

#### PLATE 34, FIGURE 2

This race, which comes from the north coastal region east of Matanzas, is smaller than typical *C. (C.) auberianum auberianum* and has the sculpture much stronger and lacks the semivarnished aspect of that race. In strength of sculpture it resembles the Floridian *C. (C.) dentatum* Say but differs from that by having the axial riblets much less crowded.

The type, U.S.N.M. no. 134930, comes from Palma Sola east of Punta de Maya, that is, between Matanzas and Cardenas. It has 4.3 whorls remaining and measures: Length, 10.2 mm; greater diameter, 5.2 mm; lesser diameter, 4.4 mm.

#### CHONDROPOMISCA, new subgenus

Small shells, varying from ovate to broadly ovate in outline, with the spiral threads a little stronger than the axial riblets, the junctions of the two forming sharply pointed cusps. The summit of the whorls is rendered finely denticulated by the axial riblets. Peristome double, the outer only moderately expanded.

Type: *Cyclostoma (Chondropoma) rufopictum* (Gundlach) Pfeiffer.

## KEY TO THE SPECIES OF SUBGENUS CHONDROPOMISCA

Shell inflated, very broadly ovate.

Sculpture very coarse..... **greenfieldi**

Sculpture fine..... **revocatum**

Shell not inflated, not very broadly ovate.

Shell ovate.

Nodulations of whorls strong..... **rufopictum**

Nodulations of whorls not strong.

Nodulations very fine and regular.

Axial and spiral sculpture of equal strength..... **solidulum**

Axial and spiral sculpture not of equal strength.

Spiral sculpture stronger than axial..... **unilabiatum**

Shell not ovate.

Shell elongate-ovate..... **aguayoi**

## CHONDROPOMA (CHONDROPOMISCA) RUFOPICTUM (Gundlach) Pfeiffer

## PLATE 39, FIGURE 2

1860. *Cyclostoma* (*Chondropoma*) *rufopictum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 7, pp. 30-31.

Shell small, ovate, the first postnuclear turn is dark brown on the posterior half, the rest, as well as the succeeding whorls, are flesh-color, with spots of brown arranged in axial and spiral series. Postnuclear whorls well rounded but not inflated, narrowly shouldered at the summit, marked by rather strong, slightly retractively slanting, slender axial ribs, which are rather distantly spaced on all the turns, and five feeble spiral cords, which are obsolete on the first turn; the junctions of the spiral cords and the axial riblets form poorly developed nodules, an occasional one of which is thin and hollow. The axial riblets extend strongly to the shoulder at the summit, which they render crenulated. Suture almost channeled. Periphery obsoletely angulated. Base well rounded, rather openly umbilicated, the outer limit of the umbilicus marked by a strong spiral cord and two, a little less strong are present within the umbilicus. In addition to this, the base is marked by the continuation of the axial riblets. Aperture pyriform; peristome double, the inner slightly reflected and marked by alternate rays of pale brown and darker brown; the outer closely approximated to the inner all around except at the posterior angle where it is projected to form a slight ear. Here several lamellae are present, filling the gap between the two peristomes; the parietal wall is appressed to the preceding turn. Operculum paucispiral with subcentral nucleus, the outside covered with a thin deposit of fine granules.

Of this Gundlach states, *loc. cit.*: "On trees and shrubs at Baracoa. Animal pale or bright brownish. Black splotches or spots on the neck and are present in greater numbers on the anterior end of the

head where they become confluent. White blotches are present on the sides of the body. Head red within; base of tentacles whitish rose-red, the middle mennig-red with the tip thickened and gray."

The specimen described and figured, U.S.N.M. no. 354934, is one of two from the Redfield collection obtained from Poey and labeled as coming from Jacquecito, Baracoa. It has 4 whorls and measures: Length, 9.4 mm; greater diameter, 6.1 mm; lesser diameter, 5.0 mm.

**CHONDROPOMA (CHONDROPOMISCA) UNILABIATUM (Gundlach) Pfeiffer**

Shell small, white, horn-color, yellow or orange. Nuclear whorls 2.5, very inflated, strongly rounded, forming a blunt apex, smooth, excepting the last portion of the last whorl, which shows the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, narrowly shouldered at the summit, marked by retractively slanting axial riblets, which are a little more closely crowded upon the last than the earlier turns. In addition to these riblets, the whorls are marked by slender spiral cords, which render their junctions with the axial riblets regularly, finely nodulose, while the spaces enclosed between them are somewhat curved, rectangular and narrow, having their long axis parallel with the axial sculpture. The angle at the summit of the whorls is rendered crenulated by the tubercles of the first spiral cord. Suture almost channeled. Periphery well rounded. Base very broad, somewhat inflated, well rounded, narrowly openly umbilicated, marked by almost equal and equally spaced spiral threads, which render the axial riblets which continue over the base, wavy; the outer limit of the umbilicus is marked by a strong spiral cord and a second a little less strong on the midspace of the umbilical wall; the umbilical wall is also marked by the continuations of the fine axial riblets. Aperture broadly oval; peristome expanded with a poor indication toward doubling at the posterior portion of the inner lip, rather broadly expanded and reflected; parietal wall appressed and fused to the preceding turn; operculum paucispiral with subcentral nucleus.

Of this Gundlach says, *loc. cit.*: "On cliffs at Baracoa. Animal gray; whitish dots form spots by their confluence on the sides of the foot, on the base of the tentacles and on the neck. Black marks or wavy confluent lines are present on the snout and in lesser numbers upon the head. Tentacles of coral-red color without dots, their base brighter with gray tip."

This species occupies the region about Baracoa where several races are present, each with a rather restricted habitat.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMISCA*) *UNILABIATUM*

Sculpture strong.

Outer lip with a deep orange axial zone within.

Shell pale orange..... *unilabiatum*

Shell deep orange..... *rubrum*

Outer lip without a deep orange axial zone within..... *dunkeri*

Sculpture not strong..... *obsoletum*

*CHONDROPOMA* (*CHONDROPOMISCA*) *UNILABIATUM UNILABIATUM* (Gundlach)  
Pfeiffer

PLATE 39, FIGURE 3

1860. *Cyclostoma* (*Chondropoma*) *unilabiatum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 7, p. 31.

This race comes from the Fort at El Paraiso, Baracoa. It is smaller and paler red than *C. (C.) unilabiatum rubrum* and also has the red axial zone of the inside of the outer lip paler and less extensive.

The specimen figured, U.S.N.M. no. 354940, is one collected by Gundlach. It has 4 whorls remaining and measures: Length, 9.5 mm; greater diameter, 6.3 mm; lesser diameter, 5.2 mm.

*CHONDROPOMA* (*CHONDROPOMISCA*) *UNILABIATUM RUBRUM*, new subspecies

PLATE 39, FIGURE 1

This race comes from the east side of Baracoa Harbor. It is distinguished from typical *C. (C.) unilabiatum* by its larger size and much more intensely red coloration of both shell and interior of outer lip.

The type, U.S.N.M. no. 468967, has 4.5 whorls remaining and measures: Length, 11.4 mm; greater diameter, 7.8 mm; lesser diameter, 6.0 mm.

*CHONDROPOMA* (*CHONDROPOMISCA*) *UNILABIATUM OBSOLETUM*, new subspecies

PLATE 39, FIGURE 7

1860. *Cyclostoma* (*Chondropoma*) *unilabiatum*  $\beta$  (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 7, p. 31.

This subspecies comes from Mata, east of Baracoa. Here the color varies from white to yellow to pale orange, while the axial and spiral sculpture in both are decidedly reduced.

The type, U.S.N.M. no. 354941, has 4 whorls remaining and measures: Length, 10.2 mm; greater diameter, 6.5 mm; lesser diameter, 5.3 mm.

## CHONDROPOMA (CHONDROPOMISCA) UNILABIATUM DUNKERI (Arango) Pfeiffer

## PLATE 39, FIGURE 4

1866. *Chondropoma dunkeri* (ARANGO) PFEIFFER, Malakozool. Blätter, vol. 13, p. 63.

This subspecies comes from Cayojuin near Baracoa. Here the outer lip lacks the axial orange band within the aperture; the spiral sculpture is also a little stronger than in the other races.

The specimen described and figured, U.S.N.M. no. 354939, a topotype, collected by Arango at Cayojuin, has 4 whorls remaining and measures: Length, 9.5 mm; greater diameter, 6.3 mm; lesser diameter, 5.2 mm.

## CHONDROPOMA (CHONDROPOMISCA) SOLIDULUM (Gundlach) Pfeiffer

Shell small, when truncated ovate, of flesh-colored or pale yellow ground color, marked with rather distantly spaced dots of brown, which form interrupted spiral bands and axial zones, for the dots are arranged in both spiral and axial series. Nuclear whorls 2, smooth, well rounded, forming a somewhat truncated apex. Post-nuclear whorls narrowly shouldered at the summit, the early ones marked by slender axial riblets, which are retractively slanting and feeble spiral threads. On the succeeding whorls the spiral threads gain in strength until they equal or even excel the axial riblets and form at their junction with the axial riblets conspicuous oval nodules, which have their long axis parallel with the axial sculpture. The axial ribs on the major portion of the turns are not quite so wide as the spaces that separate them and they rather conspicuously crenulate the channeled suture. Periphery well rounded; base short, moderately openly umbilicated, and marked by the continuation of the axial ribs and spiral cords equaling those on the spire. The umbilical wall is also marked by spiral cords and the continuation of the axial ribs. Aperture broadly oval; peristome double, the outer and inner fused at the edge except on the parietal wall and the posterior angle of the aperture where they show distinctness. The peristome is slightly expanded on the outer lip and adnate to the preceding turn on the parietal wall. Operculum paucispiral, with the outside covered with a thin deposit of calcareous granules.

Of this species Gundlach says: "On the seashore at Baracoa, under rocks and dried leaves of *Cocoloba*. Animal whitish with white dots which are fused on the side into spots, and other dots of black on the neck, head and snout. Head reddish within. Tentacles with their base rose-red, turning gray toward the tip which is thickened and quite dark."

This species ranges from Baracoa westward along the coast through Sagua de Tanamo to Vita, breaking up into several subspecies.



KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMISCA*) *SOLIDULUM*

Ground color of shell flesh-color----- *vitaense*  
 Ground color of shell yellow.

Length of decollated shell more than 10 mm----- *solidulum*  
 Length of decollated shell less than 9 mm----- *tanamense*

*CHONDROPOMA* (*CHONDROPOMISCA*) *SOLIDULUM VITAENSE*, new subspecies

## PLATE 39, FIGURE 6

This race comes from Vita Harbor. It is a pale race, in which the ground color is flesh-color, which renders the interrupted spiral markings all the more conspicuous. It is also larger than the other two races.

The type, U.S.N.M. no. 468968, comes from the west side of Vita Harbor. It has 3.3 whorls remaining and measures: Length, 11.6 mm; greater diameter, 7.3 mm; lesser diameter, 6.8 mm.

*CHONDROPOMA* (*CHONDROPOMISCA*) *SOLIDULUM SOLIDULUM* (Gundlach) Pfeiffer

## PLATE 39, FIGURE 9

1860. *Cyclostoma* (*Chondropoma*) *solidulum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 7, p. 30.

The typical race comes from Baracoa. We also have it from Cayojuin west of Baracoa.

This race closely resembles that of *C. (C.) solidulum tanamense*, from which it is differentiated by its uniformly larger size.

The type, U.S.N.M. no. 493116, has a little more than 4 whorls remaining and measures: Length, 10.4 mm; greater diameter, 5.8 mm; lesser diameter, 5.2 mm.

*CHONDROPOMA* (*CHONDROPOMISCA*) *SOLIDULUM TANAMENSE*, new subspecies

## PLATE 39, FIGURE 5

1920. *Chondropoma* (*Chondropoma*) *solidulum tanamensis* (TORRE) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 62 (*nomen nudum*).

This race comes from Sagua de Tanamo. It resembles the typical race in every way except in being much smaller.

The type, U.S.N.M. no. 493122, has 3.5 whorls remaining and measures: Length, 8.8 mm; greater diameter, 6.3 mm; lesser diameter 5.5 mm.

*CHONDROPOMA* (*CHONDROPOMISCA*) *REVOCATUM* (Gundlach) Pfeiffer

## PLATE 39, FIGURE 10

1857. *Cyclostoma revocatum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 4, p. 178.

1858. *Chondropoma revocatum* (GUNDLACH) PFEIFFER, Malakozool. Blätter, vol. 5, p. 191.

Shell moderately large, when truncated almost subglobose, pale orange-red. Nuclear whorls almost 2, inflated, strongly rounded, the initial portion chestnut-brown, without sculpture. Postnuclear whorls very strongly inflated, strongly rounded, narrowly shouldered at the summit, unicolor, marked by numerous slender retractively curved axial riblets, which are only about one-fourth as wide as the spaces that separate them and spiral cords of about the same strength and spacing. The junctions of these two elements form minute cusps, while the spaces enclosed between them are rectangular pits having their long axis parallel with the axial sculpture. Periphery inflated, strongly rounded. Base inflated, strongly rounded, moderately openly umbilicated and marked like the spire. This sculpture also extends onto the umbilical wall, but here the axial riblets become very closely approximated. The last whorl is solute for a short fraction of a turn. Aperture very broadly ovate; peristome double, the inner exerted and reflected quite distinct from the outer; the outer moderately broad, obliquely expanded and marked by feebly concentric lamina, rendered crenulated by the external sculpture. On the parietal wall, however, the outer peristome is much narrower than on the rest of the turns. Operculum thin, paucispiral, with subcentral nucleus and a fine granular deposit on the outside.

Of the animal of this species Gundlach<sup>13</sup> says: "Below rocks and dry leaves in shrubbery. The animal is light in color, dotted with fine white dots, the snout and forehead are marked by minute dark dots and is transversely sharply delineated. There are also some fine dots between the antennae, which are cinnabar red with somewhat brownish tips. The head is reddish within, but the head itself, as well as the base of the tentacles, are white. The digestive system is visible through the substance of the animal."

The specimen figured, U.S.N.M. no. 493125, is a cotype collected by Gundlach at the Estero en Cabo Cruz. It has 3.5 whorls remaining and measures: Length, 11.8 mm; greater diameter, 8.7 mm; lesser diameter, 7.2 mm.

**CHONDROPOMA (CHONDROPOMISCA) GREENFIELDI, new species**

**PLATE 39, FIGURE 8**

Shell rather large, when truncated subglobular, flesh-color, with interrupted spiral bands of brown, the dots composing which are also arranged in axial series. Nuclear whorls 2.3, inflated, strongly rounded, finely granulose, the initial portion dark chestnut brown. Postnuclear whorls very strongly inflated, rounded, very narrowly shouldered at the summit, forming a slightly channeled suture,

<sup>13</sup> Malakozool. Blätter, vol. 5, p 191, 1858.

marked by rather distantly spaced, moderately strong, retractively slanting axial riblets, and much stronger distantly spaced spiral cords, which on the last turn show intercalated cords of a finer strength than the major cords. Periphery inflated, strongly rounded. Base inflated, openly moderately broadly umbilicated, strongly rounded and marked like the spire, with spiral cords of similar strength and a continuation of the axial riblets. On the umbilical wall the axial riblets become slenderer, more lamellose and more closely approximated, while the spiral sculpture becomes decidedly reduced. The last whorl is solute for a slight fraction of a turn. Aperture broadly oval; peristome double, the inner decidedly exerted and slightly reflected; the outer obliquely expanded, narrower on the parietal wall than on the rest, marked by slender concentric laminae and forming somewhat of an auricle at the posterior angle. Operculum thin, paucispiral, with almost submarginal nucleus.

The type, U.S.N.M. no. 390425, was collected by Bartsch at the mouth of the Rio Ojo del Toro, Oriente, Cuba. It has 4 whorls remaining and measures: Length, 14.2 mm; greater diameter, 11.0 mm; lesser diameter, 8.2 mm.

The large series of specimens before us from this locality and the mouth of the Rio Puerco, a nearby stream, shows this to be a perfectly distinct species, which in many ways recalls *C. (C.) revocatum*, but its larger size and much coarser sculpture apparently without intergrades entitle it to specific rank.

Of the animal of this species Bartsch's field notes, taken at Rio Puerco, August 30, 1930, state: "Forehead very pale pinkish brown, tentacles smoke gray, moderately long slender ovally expanded at the tip. Snout pale buff with a smoky tinge. Side of the body pale smoky gray. Sole of the foot short, medially cleft, wave motion of the two sides alternate. Progression is by short jerks, the shell being carried obliquely."

Found under stones, quite abundant.

CHONDROPOMA (CHONDROPOMISCA) AGUAYOI, new species

PLATE 35, FIGURE 9

Shell elongate-ovate, pale straw-color, with the first portion of the remaining whorls chestnut-brown, which is also the color of the line marking the plug in the truncated end. There are also present very weak, rather distantly spaced, interrupted lines of brown. Nuclear whorls decollated in all our specimens; postnuclear whorls moderately rounded, narrowly shouldered at the summit and marked by slender, retractively curved, somewhat sinuous, axial riblets and spiral threads of the same strength, the combination of the two producing

fine, low, rounded nodules at their intersection. The axial riblets are slightly closer spaced than the spiral threads. Of the spiral threads, 16 occur between the periphery and the summit on the last turn. Periphery well rounded; base moderately long, strongly rounded and marked by the continuation of the axial riblets which extend into the umbilicus, and 14 spiral threads of about the same strength as those on the spire. The umbilicus is rather wide, and in addition to the axial riblets shows strong spiral threads. Aperture ovate; peristome double, white, the outer narrowly expanded, forming a conspicuous pointed auricle at the posterior angle, the inner also expanded and appressed to and adnate to the outer, conspicuously separated only at the auricle. Operculum thin, paucispiral, corneous.

The type, U.S.N.M. no. 493291, was collected by John B. Henderson at Santa Lucia, La Silla, Oriente. It has 4.4 whorls remaining and measures: Length, 15.3 mm; greater diameter, 9.0 mm; lesser diameter, 7.4 mm.

This species can readily be distinguished from the other members of *Chondropoma* (*Chondropomisca*) by its much more elongated form.

#### Subgenus CHONDROPOMARTES Henderson and Bartsch

1921. *Chondropomartes* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 53, p. 60.

Shell ovate-conic, the intersections of the axial ribs and spiral threads forming sharp cusps. Operculum with a very heavy callus.

This group, as set up by Henderson and Bartsch, was a heterogeneous assemblage. Additional material collected about Matanzas shows that *C. (C.) presasianum*, the type species, is connected with intergradient forms with *C. (C.) irradians*. While the hollow spines formed by the intersection of the axial ribs and spiral sculpture may be reduced to almost the vanishing point, they are, nevertheless, indicated in all the forms.

The present arrangement was made possible and easily intelligible by the accessions obtained by Dr. de la Torre and from his coworkers, which show that the subgenera as now conceived constitute a perfectly natural group. An interesting character is the very heavy callus on the operculum. The group, as now constituted, centers about Matanzas.

Type: *Chondropoma presasianum* (Gundlach) Pfeiffer.

#### KEY TO THE SPECIES OF SUBGENUS CHONDROPOMARTES

Spines very strong-----	<i>presasianum</i>
Spines very fine-----	<i>irradians</i>
Spines intermediate between the above-----	<i>portuandoi</i>

**CHONDROPOMA (CHONDROPOMARTES) PRESASIANUM (Gundlach) Pfeiffer**

Shell elongate-conic, flesh-color, with brownish markings that form axial and interrupted spiral elements. These bands of brown show up best on the expanded portion of the outer peristome, where they form alternate areas with the ground color. Postnuclear whorls well rounded, narrowly shouldered at the summit, marked by sublamellar, somewhat wavy, retractively slanting axial ribs and spiral cords; the junctions of the two form hollow tubercular spines, which, when the tip is broken away, prove to be made up of a mere thin shell of substance. The spaces enclosed between the spiral cords and the axial ribs are rectangular areas having their long axis parallel with the axial sculpture. Suture well constricted. Periphery inflated, strongly rounded. Base inflated, strongly rounded, openly umbilicated, and marked by the continuations of the axial riblets and spiral threads, which equal those on the spire. The umbilical wall is also similarly marked, but here the sculpture becomes somewhat reduced. Aperture oval, with a slight contraction at the posterior angle; peristome double, the inner forming a ring, which is slightly expanded, slightly reflected, smooth, and somewhat thickened, the outer forming a very broad, flaring, slightly up-curved expansion, which extends all around in equal width except where it touches the preceding turn at the parietal wall, where it is very narrow. This flaring portion is marked by a series of wavy scalloped lamellae, which form a regular series of elevations and depressions from the inner peristome outward to the outer margin. These lamellae are very delicate and in many of the specimens examined have been lost, probably in the cleaning process. On the outside of this expanded portion the ridges forming the fimbriations prove to be extensions of the spiral cords, the areas between them being broader. Operculum thin, horny, paucispiral, with subcentral nucleus, the outside of all but the central whorls being covered with minute calcareous granules.

Bartsch's field notes, Station 20, Finca El Pan, July 21, 1928, state:

"Animal short, forehead marked with numerous short brownish streaks. This darkish area is bordered on each side by a flesh-colored zone, which is slightly tinged with smoke gray. This same color extends from this area over the tentacles, which are flesh-color, almost white, with a grayish tinge. The tentacles swell out slightly toward the tip and here are a little darker in color. Sides of the body smoke gray. Sole of foot a little paler than the sides, deeply medially cleft. Motion of the two sides alternate."

The animals, after being removed from the stones to which we found them cemented, would withdraw deeply within their shells and refuse to come out. Only one did so after a very long wait. In

this respect it differs radically from *Chondropoma* (*Chondropomartes*) *irradians*, which is ever ready to move.

This species comes from El Palenque and the adjacent limestone blocks, and extends west to Canasi. We are recognizing two subspecies.

KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMARTES) PRESASIANUM

Shell small, pale and slender----- *canasiense*  
 Shell moderately larger, darker, and stouter----- *presasianum*

CHONDROPOMA (CHONDROPOMARTES) PRESASIANUM CANASIENSE, new subspecies

PLATE 37, FIGURE 5

This race comes from near Canasi, west of Matanzas. It is smaller, slenderer, and paler than *C. (C.) presasianum presasianum*.

The type, U.S.N.M. no. 367754, was collected by Arango. It has 4.8 whorls remaining and measures: Length, 14.4 mm; greater diameter, 10.0 mm; lesser diameter, 7.0 mm.

CHONDROPOMA (CHONDROPOMARTES) PRESASIANUM PRESASIANUM (Gundlach)  
 Pfeiffer

PLATE 37, FIGURE 4

1563. *Chondropoma presasianum* (GUNDLACH) PFEIFFER, Malakozool Blatter, vol 10, p. 188.

This, the typical race, occupies the main range of El Palenque as well as some of the limestone blocks that have become separated from it by erosion. It is larger, stouter, and darker than *C. (C.) presasianum canasiense*.

The specimen figured, U.S.N.M. no. 499603, comes from the Elena Farm, El Palenque. It has 5.2 whorls remaining and measures: Length, 18.0 mm; greater diameter, 12.8 mm; lesser diameter, 7.5 mm.

CHONDROPOMA (CHONDROPOMARTES) PORTUANDOI, new species

PLATE 37, FIGURE 3

Shell elongate-conic, early whorls dark, the rest pale yellow with broad interrupted spiral bands of brown; peristome is very darkly and conspicuously rayed. Nuclear whorls 2.2, decidedly inflated and strongly rounded, forming a blunt apex. Postnuclear whorls marked by slender, slightly retractively curved axial and spiral threads, the latter a little stronger than the axial; the junction of the two forms low feeble hollow spines. Suture moderately constricted. Periphery inflated, well rounded. Base short, inflated, strongly rounded, openly umbilicated, and marked by the continua-

tion of the axial riblets and spiral threads, those on the posterior half of the base being finely spinose and those on the anterior half and within the umbilicus finely scalloped. Aperture broadly oval; peristome double, the outer very broadly expanded, fluted and marked with closely spaced lamellae; inner peristome slightly exerted and reflected, appressed to the outer. Operculum thin, paucispiral, with submarginal nucleus covered by a granular calcareous deposit.

The type, U.S.N.M. no. 567755, has a little more than 4 whorls remaining and measures: Length, 16.8 mm; greater diameter, 12.2 mm; lesser diameter, 7.5 mm.

This species, like *C. (C.) irradians*, is lively and readily comes from the shell when it is permitted to remain quiet for a little while.

This species was collected by Portuando and later by Bartsch on two small limestone blocks lying off the north side of El Palenque near the house of Desidero Sanchez.

This species has the combined characteristics of *C. (C.) presasianum* and *C. (C.) irradians*. It is possible that it may represent a hybridization of the two. However, all of our specimens are so uniform in their characters that if hybridization is their source then fixation has taken place.

**CHONDROPOMA (CHONDROPOMARTES) IRRADIANS (Shuttleworth) Pfeiffer**

Shell elongate-conic, varying in ground color from white to pale horn-color to pale brown. The postnuclear whorls are marked with interrupted spiral bands of brown of varying width, which are also arranged in axial series, the bands on the spire being a little broader than those on the base. Interior of aperture of the same color as the outside. Peristome white, with broad brown rays. There is an oblique brownish band marking the plug at the truncated end. Nuclear whorls 2.3, strongly rounded, smooth with a few incremental lines at the termination of the nuclear spire; the whorls remaining well rounded, narrowly shouldered at the summit, marked by feeble, retractively slanting, moderately closely spaced axial and spiral threads, the latter a little stronger than the axial. The junctions of these two elements form feeble nodules, while the spaces enclosed between them are more or less squarish pits. The spiral threads near the summit show more of a tendency toward nodulation than those on the middle of the turns. Periphery of the last turn well rounded. Base short, well rounded, marked by the continuation of the feeble axial and spiral threads. The latter are here of about the same strength as those on the spire, but rendered a little more strongly nodulose by the axial threads than on the spire. The base

is openly umbilicated. The outside of the umbilical wall is marked by the continuation of the axial riblets and spiral threads. Aperture moderately large, ovate; peristome double, the outer very broadly, flaringly expanded, not quite in one plane but somewhat wavy, of about the same width all around except at the parietal wall where it is much narrower and where it is appressed and adnate to the preceding turn. The expanded outer peristome is composed of a series of concentric lamellae. The inner peristome is a little thicker, moderately elevated, slightly expanded and reflected. Operculum thin, corneous, paucispiral, with the nucleus almost submarginal, the outside covered with a deposit of fine calcareous granules, which are placed in a more or less wavy pattern.

Of the animal of *C. (C.) irradians palenquense* Bartsch took the following field notes at El Palenque, July 21, 1928, Station 19:

"Animal short, with numerous small elongate spots of brown on the forehead, which give to the back a somewhat brownish appearance. Base of tentacles with a whitish buffy ring bordered on the sides by a streak of the same color. Tentacles ashy gray, muzzle light ashy buff. Sides of the body buffish gray. Sides of foot ashy; sole of foot ashy with a faint yellowish tinge, deeply medially cleft. Motion of the two sides alternate."

In this species the animal readily comes out of the shell if it is allowed to remain quiet for a little while. In this respect it differs radically from *C. (C.) presasianum*, which refuses to come forth readily.

This species ranges from Loma Quintinal through Vista Alegre, through Abra Figueroa, through Pan de Matanzas, through El Palenque, and through the Sierra Camarones to Vieja Beremeja.

We are recognizing six subspecies.

Distribution of the subspecies of *C. (C.) irradians* is shown in figure 101.

#### KEY TO THE SUBSPECIES OF CHONDROPOMA (CHONDROPOMARTES) IRRADIANS

Ground color pale brown.

Shell large..... panense

Shell not large.

Shell brilliantly banded..... figuroense

Shell not brilliantly banded..... irradians

Ground color not pale brown.

Ground color flesh-color.

Decollated shell more than 17 mm..... palenquense

Decollated shell less than 15 mm..... camaronense

Ground color not flesh-color, but white..... candicans



## CHONDROPOMA (CHONDROPOMARTES) IRRADIANS IRRADIANS (Shuttleworth) Pfeiffer

## PLATE 37, FIGURE 1

1852. *Chondropoma irradians* (SHUTTLEWORTH) PFEIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 209.

1854. *Chondropoma irradians* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, vol. 1, sect. 19, p. 273, pl. 37, figs. 9-10.

The typical form of this species was collected by Rugel at Loma Quintinal, near Matanzas, and by him sent to Shuttleworth, who in turn sent a letter to Pfeiffer, who published Shuttleworth's description as cited above. We have four specimens also collected by Rugel, one of which we figure, which indicate plainly that this is the small dark race which extends from Quintinal southwestward through the limestone block terminating at Vista Alegre.

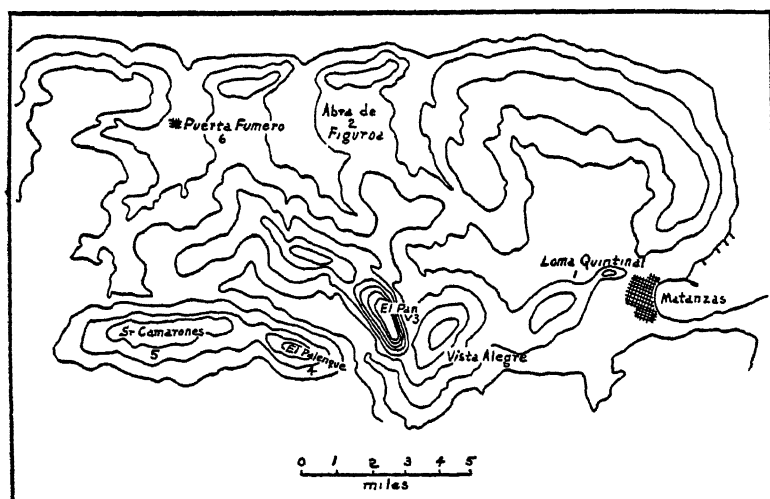


FIGURE 101.—Distribution of the subspecies of *Chondropoma* (*Chondropomartes*) *irradians*: (1) *irradians*; (2) *figuroense*; (3) *panense*; (4) *palenquense*; (5) *camaroneuse*; (6) *candicans*.

The small size and dark color are its distinguishing features.

The specimen figured, U.S.N.M. no. 493126, has a little more than 5 whorls remaining and measures: Length, 13.8 mm; greater diameter, 9.0 mm; lesser diameter, 6.0 mm.

## CHONDROPOMA (CHONDROPOMARTES) IRRADIANS FIGUROENSE, new subspecies

## PLATE 36, FIGURE 3

This is the brilliantly colored race occupying the Abra de Figueroa. It is a little larger than the typical race and much more brightly colored.

The type, U.S.N.M. no. 499606, one of a large series from the same place, is almost a complete specimen. It has 7 whorls remaining and measures: Length, 19.5 mm; greater diameter, 12.0 mm; lesser diameter, 6.8 mm.

**CHONDROPOMA (CHONDROPOMARTES) IRRADIANS PANENSE, new subspecies**

PLATE 36, FIGURE 4

This, the largest race collected by Presas, Gundlach, Wright, Torre, Henderson, Bartsch, and others on the south exposure of Pan de Mantanzas, is comparatively dull in color and less strongly sculptured than the rest.

The type, U.S.N.M. no. 493133, has 5 whorls remaining and measures: Length, 18.9 mm; greater diameter, 13.8 mm; lesser diameter, 8.1 mm.

**CHONDROPOMA (CHONDROPOMARTES) IRRADIANS PALENQUENSE, new subspecies**

PLATE 36, FIGURE 5

A large series of specimens from a number of stations on the north face of El Palenque, while agreeing fairly well in size with *C. (C.) irradians figuroense*, are paler in coloration and a little more strongly sculptured.

The type, U.S.N.M. no. 367756, has 4 and the basal half of the first of the remaining turns and measures: Length, 17.8 mm; greater diameter, 12.2 mm; lesser diameter, 7.2 mm.

**CHONDROPOMA (CHONDROPOMARTES) IRRADIANS CAMARONENSE, new subspecies**

PLATE 36, FIGURE 2

This race, which comes from the Sierra de Camarones, is as small and as stout as *C. (C.) irradians candicans* but of buff instead of white ground color. The outer peristome is unusually broadly expanded.

The type, U.S.N.M. no. 499607, comes from a cliff about 500 meters west of Peña del Leon. It has about 4.5 whorls remaining and measures: Length, 15.4 mm; greater diameter, 11.8 mm; lesser diameter, 6.5 mm.

**CHONDROPOMA (CHONDROPOMARTES) IRRADIANS CANDICANS, new subspecies**

PLATE 36, FIGURE 1

This, the palest of all the known races, has the ground color white, which renders the interrupted spiral bands of brown quite contrasted. The sculpture is also a little finer than in the other subspecies. In size it agrees with *C. (C.) irradians camaronense*.

The type, U.S.N.M. no. 367757, comes from Potrero Fumero, Vieja Bermeja. It has 4 whorls remaining and measures: Length, 14.0 mm; greater diameter, 10.8 mm; lesser diameter, 7.4 mm.

GUTIERREZIUM, new subgenus

Shell turbate. Nuclear whorls, 1.8, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, and marked by slender axial ribs and spiral threads, which vary in strength from that equal to the axial ribs to almost obsolete in different species. The junctions of the axial and spiral sculpture form pronounced tubercles. On the last whorl the sculpture usually becomes almost obsolete. Periphery strongly rounded. Base inflated, strongly rounded, and marked by the continuation of the fine axial riblets and spiral threads a little stronger than those on the spire of the last turn. These form cords in the rather widely open umbilicus. Aperture broadly ovate; peristome double, the outer very broadly expanded excepting on the parietal wall where it is narrower; the inner slightly projecting and reflected partly over the outer. Operculum thin, corneous, paucispiral with subcentral nucleus.

Type: *Chondropoma* (*Gutierrezium*) *bairense*, new species.

This subgenus is closely allied to *Chondropomella* Bartsch of Santo Domingo, which is typified by *Chondropoma* (*Chondropomella*) *magnifica* (Sallé) Pfeiffer. Here, however, we have the spiral sculpture extending upon the whorls between the periphery and summit of the turns, which is not the case in *Chondropomella*. In some of the species this sculpture is quite reduced and requires to be looked for sharply not to be overlooked.

KEY TO THE SPECIES OF SUBGENUS GUTIERREZIUM

Suture channeled.

Spiral sculpture strong..... *bairense*

Spiral sculpture feeble..... *canaliculatum*

Suture not channeled.

Axial ribs closely spaced.

Outer peristome very broadly expanded..... *montanum*

Outer peristome only moderately expanded..... *guisaense*

Axial ribs distantly spaced..... *gutierrezii*

CHONDROPOMA (GUTIERREZIUM) BAIRENSE, new species

PLATE 38, FIGURE 2

Shell broadly ovate, turbate; the early whorls chestnut-brown, the succeeding turns flesh-color, marked by almost conspicuous interrupted spiral bands of brown, of which four are present on the spire and four on the base. They also mark the outer peristome and the

inside of the outer lip. Nuclear whorls decollated; postnuclear whorls very strongly inflated and very strongly rounded, marked by closely spaced, retractively slanting axial riblets and spiral threads of about the same strength. Both of these are much stronger on the early whorls than on the last. The combination of these two elements gives a fenestrated pattern to the sculpture. The axial riblets render the summit of the turns feebly denticulated. Suture strongly constricted. Periphery decidedly inflated, strongly rounded. Base short, inflated, strongly rounded and marked on the posterior half like the spire, while anteriorly it bears a number of strong spiral cords. Umbilicus very broad, its wall marked with slender spiral threads which become a little stronger toward the outer margin. Aperture broadly oval; peristome double, the outer flaringly expanded, forming a very conspicuous auricle at the posterior angle a little narrower on the parietal wall. Inner peristome also expanded and reflected over the outer, which it almost half covers. Operculum thin, corneous, paucispiral with subcentral nucleus, the outside covered with a thin layer of calcareous granules.

The type, U.S.N.M. no. 367817, was collected by Dr. de la Torre near Baïre. It has 4 whorls remaining and measures: Length, 16.2 mm; greater diameter, 13.2 mm; lesser diameter, 10.4 mm.

This, the type of the subgenus *Gutierrezium*, is easily differentiated from all the other forms of this subgenus by its strong spiral sculpture.

**CHONDROPOMA (GUTIERREZIUM) CANALICULATUM, new species**

**PLATE 38, FIGURE 5**

Shell very broadly ovate, the early whorls chestnut-brown, the succeeding turns yellowish flesh-color, the last one flesh-color, marked with interrupted spiral bands of chestnut-brown, which are arranged also in axial series. Four of these bands occur on the spire and three on the base. These are very conspicuous on the outer and basal lip, as well as on the outer peristome. Nuclear whorls 1.8, strongly rounded, marked with microscopic granulations only. Postnuclear whorls inflated, strongly rounded, marked by decidedly retractively slanting axial riblets, which serrulate the margin of the channeled suture. These riblets are a little more distantly spaced on the early turns than on the last. In addition to this, the whorls are marked by feeble spiral threads, too feeble to more than merely render the axial riblets vertebrated at their junction. Suture strongly constricted; periphery inflated, strongly rounded. Base short, inflated, strongly rounded, very openly umbilicate, and marked like the spire but with the spiral lirations a little stronger. The umbilical wall, however, is marked by very strong spiral threads. Aperture broadly ovate, decidedly auriculated at the posterior angle. Peristome double, the

outer broadly expanded, not all in one plane, and somewhat flexuose, decidedly auriculated at the posterior angle and slightly inbent at the umbilicus, a little narrower on the parietal wall than on the rest of the shell. Inner peristome slightly exserted and reflected over the outer. Operculum thin, corneous, paucispiral, the nucleus halfway between margin and subcentral covered with a thin deposit of calcareous granules on the outside.

The type, U.S.N.M. no. 168902, an almost complete specimen, has 5.5 whorls remaining and measures: Length, 16.0 mm; greater diameter, 12.3 mm; lesser diameter, 8.9 mm. It was collected by Dr. Vaughan at Los Negros, Oriente Province.

This species is readily distinguished from the other members of the genus by its decidedly channeled suture.

**CHONDROPOMA (GUTIERREZIUM) MONTANUM, new species**

PLATE 37, FIGURE 2

Shell broadly ovate, pale buff, marked by interrupted spiral bands of brown, of which three occur on the whorls of the spire and three on the base. These bands become conspicuous on the last portion of the last whorl and lend to the inside of the outer lip and the expanded peristome a very strongly banded aspect. Here an intercalated zone appears between the first basal and second, making seven bands on the peristome. The elements composing the interrupted spiral bands are arranged in both axial and spiral series. Nuclear whorls 2.1, well rounded, smooth. Postnuclear whorls strongly inflated, well rounded, marked by slender, decidedly retractorily slanting, axial riblets, which are a little more widely spaced on the first two turns than on those succeeding. On the last whorl they are considerably reduced. The spiral sculpture consists of the merest suggestion of obsolete threads. Suture very strongly constricted with the merest indication of channeling immediately behind the aperture. Periphery inflated, strongly rounded. Base short, inflated, open umbilicated, and marked by the continuation of the axial riblets and indications of spiral threads. Within the umbilicus, however, stronger definite spiral threads are present. Aperture broadly oval, almost subcircular, decidedly auriculated at the posterior angle. Peristome double, the outer very broadly expanded and reflected, narrower on the parietal wall than on the rest, marked by slender concentric laminae. The inner slightly exserted and reflected over the outer. Operculum thin, corneous, paucispiral with subcentral nucleus, the outside covered with fine calcareous granules.

The type, U.S.N.M. no. 367815, is a complete specimen, having 6.5 whorls and measuring: Length, 16.0 mm; greater diameter, 10.4 mm;

lesser diameter, 8.0 mm. It comes from Altos de los Negros, Sierra Maestra, Oriente Province.

This species resembles *C. (G.) guisaense* in its general shape and sculpture but is at once distinguished by its very broadly expanded outer peristome.

CHONDROPOMA (GUTIERREZIUM) GUISAENSE, new species

PLATE 38, FIGURE 1

Shell very broadly ovate, flesh-colored, with interrupted bands of brown; the elements composing these are arranged in both axial and spiral series. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, narrowly shouldered at the summit, marked by slender, somewhat retractively slanting axial riblets, which are more distantly spaced on the early whorls than on the last. On this they form serrulations at the summit. The spiral sculpture consists of the merest indications of basal threads. Suture strongly impressed, slightly channeled for one-third of a turn behind the aperture. Periphery inflated, strongly rounded and marked like the spire. Base short, inflated, strongly rounded and marked by the continuation of the axial riblets. The broadly open umbilicus shows fairly strong spiral cords on the umbilical wall. Aperture broadly ovate, slightly auriculated at the posterior angle; peristome double, the outer moderately broadly expanded; the inner also expanded a little more than half as wide as the outer and reflected over and appressed to it, projecting but slightly above it. Peristome a little narrower on the parietal wall than on the rest of the aperture, separated in the unique type from the preceding whorl.

The type, U.S.N.M. no. 367816, was collected by Dr. de la Torre at the hill nearest to Guisa, southeast of Bayamo. It has 3.8 whorls remaining and measures: Length, 17.0 mm; greater diameter, 12.5 mm; lesser diameter, 9.8 mm.

This species in type of sculpture resembles *C. (G.) montanum* but is at once distinguished from this by its much narrower outer peristome.

CHONDROPOMA (GUTIERREZIUM) GUTIERREZI (Gundlach)

Shell ovoid-conic, flesh-color or pale horn-color, with interrupted lines of brown arranged so as to form both axial and spiral series. Nuclear whorls 1.8, well rounded, minutely granulose. Postnuclear whorls well rounded, narrowly shouldered at the summit, with a short channel in the suture immediately behind the summit on the last turn. The whorls are marked by rather strong sublamellar, narrow, somewhat sinuous, irregularly developed, and irregularly

distributed axial riblets, which extend prominently to the summit where they become somewhat expanded and occasionally somewhat thickened. These riblets extend prominently over the inflated and well-rounded periphery to the base. The spiral sculpture consists of obsolete indications of threads, which render the axial ribs slightly vertebrated. Base short, inflated, strongly rounded, broadly openly umbilicated, marked by the continuations of the axial ribs, which extend undiminished into the umbilicus, and obsolete indications of spiral threads like those of the spire. The umbilical wall is marked by strong spiral cords, which diminish in strength from the outside inward. Aperture pear-shaped. Posterior angle obtuse. Peristome decidedly expanded and obliquely reflected, not flattened; the outer lip is marked by dark spiral zones alternating with a broader white band; the parietal wall of the peristome is less broadly expanded than the rest. Operculum paucispiral with excentric nucleus, the last whorl with a thin calcareous granular deposit.

We are recognizing two subspecies.

KEY TO THE SUBSPECIES OF *CHONDROPOMA* (*GUTIERREZIUM*) *GUTIERREZI*

Decollated shell more than 17 mm----- *gutierrezi*  
Decollated shell less than 15 mm----- *negrosense*

*CHONDROPOMA* (*GUTIERREZIUM*) *GUTIERREZI* (*Gundlach*) Pfeiffer

PLATE 38, FIGURE 4

1856. *Cyclostoma gutierrezi* (GUNDLACH) POEY, *Memorias sobre historia natural de la Isla de Cuba*, vol. 2, p. 4, *nomen nudum*.

1858. *Cyclostoma gutierrezi* (GUNDLACH) PFEIFFER, *Malakozool. Blätter*, vol. 5, p. 46.

This race, which comes from the environs of Guisa, is distinguished from *C. (G.) gutierrezi negrosense* in being much larger and of paler coloration.

A specimen from the type locality, U.S.N.M. no. 104507, collected by Gundlach, has 4.1 whorls remaining and measures: Length, 18.0 mm; greater diameter, 13.7 mm; lesser diameter, 10.0 mm.

*CHONDROPOMA* (*GUTIERREZIUM*) *GUTIERREZI* *NEGROSENSE*, new subspecies

PLATE 38, FIGURE 3

This race was collected by Dr. de la Torre at Los Negros southeast of Baire. It is much smaller and darker colored than the typical *C. (G.) gutierrezi gutierrezi*.

The type, U.S.N.M. no. 367829, has 3.8 whorls remaining and measures: Length, 14.2 mm; greater diameter, 10.5 mm; lesser diameter, 8.0 mm.

Genus *CHONDROTHYRIUM* Henderson and Bartsch

1920. *Chondrothyrium* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 63.

Shell of ovate-conic form, marked by axial and spiral threads; breathing pore present in the parietal wall, connected with the outer edge of the peristome by a slit. Operculum typically chondropomoid.

Type: *Cyclostoma violaceum* Pfeiffer.

KEY TO THE SPECIES OF GENUS *CHONDROTHYRIUM*

Outer lip of outer peristome crenulated.....	<i>crenimargo</i>
Outer lip of outer peristome not crenulated.....	<i>violaceum</i>

*CHONDROTHYRIUM CRENIMARGO* (Pfeiffer)

## PLATE 28, FIGURE 16

1858. *Cyclostoma crenimargo* PFEIFFER, Malakozool. Blätter, vol. 5, p. 192.

Decollated shell elongate-ovate, flesh-color, with five interrupted narrow spiral lines of brown. Nuclear whorls decollated. Postnuclear whorls well rounded, almost appressed at the summit, marked by slender, sublamellose, wavy, retractively slanting axial riblets, which are a little more distantly spaced on the first of the remaining turns than on those that follow. These riblets extend prominently to the summit, which they render slightly crenulated. In addition to the axial riblets, the whorls are marked by spiral threads, of which 5 occur on the first of the remaining turns, 10 upon the second, and 13 upon the last between the summit and the suture. The intersections of the axial riblets and the spiral threads form slender oval nodules, the long axis of which coincides with the axial sculpture. Suture moderately constricted. Periphery well rounded, slightly inflated. Base short, somewhat inflated and rounded, narrowly openly umbilicated, marked by the continuations of the axial riblets, which extend into the umbilicus and also by the continuation of a similar type of spiral sculpture as that found on the spire. This grows a little stronger toward the umbilicus but again weakens within the umbilicus. There are eight of these spiral cords between the periphery and the outer termination of the umbilicus, then four equally strong between the outer termination of the umbilicus, and the inner straight side of the umbilicus, and about nine on the umbilical wall which are much weaker. On the base, too, we find seven lines of brownish dots coinciding with the spiral sculpture. Aperture oval, posterior angle obtuse; peristome double, the inner thickened and somewhat reflected, and decidedly projecting above the outer on the outer lip; the outer much broader and rendered decidedly wavy



from the posterior angle to the termination of the outer lip, mostly so immediately anterior to the posterior angle. This waviness gives the edge, when looked upon vertically, a crenated appearance which evidently prompted Pfeiffer's name *crenimargo*. The basal, inner, and parietal margin of the outer peristome is composed of a series of slender fused laminae whose outer limits are indicated by a mere line; the outer peristome of the inner lip is broader than the rest and is reflected over the umbilicus which, when looked upon squarely, it almost covers; the outer peristome of the parietal lip is appressed to the preceding turn with which it is fused; the breathing pore is on the parietal wall near the posterior angle of the aperture, and here the parietal wall is partly slit; operculum paucispiral with the nucleus a little more marginal than subcentral; the outside is covered with a minutely granulose coat.

All our specimens come from the type locality, Boca de Guarabo, between Cienfuegos and Trinidad, Santa Clara Province.

The specimen described and figured, U.S.N.M. no. 355039 has 3.5 whorls remaining and measures: Length, 13.7 mm; greater diameter, 7.5 mm; lesser diameter, 7.0 mm.

#### CHONDROTHYRIUM VIOLACEUM (Pfeiffer)

Shell rather variable in size and shape, the latter ranging from elongate-conic to broadly ovate. The color ranges from flesh-color through pale orange to purplish brown. The shell may be unicolor or have interrupted bands of brown. The dots comprising these bands are also arranged in axial series. Nuclear whorls 2.3, rather elevated, well rounded, smooth, with the suture of the first turn chestnut-brown. The last part of the last whorl shows the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, almost appressed at the summit, marked by numerous slender, sublamellar, somewhat retractively slanting, axial riblets and slender spiral threads the junctions of which form slender tubercles. The spiral threads also render the axial riblets somewhat wavy and give to them, when examined in profile, a somewhat scalloped appearance. Suture constricted. Periphery well rounded. Base moderately long, well rounded, marked by the continuation of the axial riblets and spiral cords, the latter increasing in strength on the anterior half, but weakening again within the umbilicus which is moderately large and open. Aperture broadly oval, in some of the races almost subcircular: peristome double, white, the inner slightly thickened, expanded and slightly reflected, and projecting above the outer peristome, which is expanded to a varying degree in the different races on the outer, basal and parietal lip. and more broadly so on the columellar side; the outer peristome is usually not flat but somewhat wavy. The

last whorl varies from solute to adnate. There is a breathing pore close to the posterior angle of the aperture on the parietal wall immediately behind the edge of the peristome, which is connected with the free edge of the peristome by a slit. Operculum thin, corneous, paucispiral, with a rather heavy deposit of calcareous granules on the outside.

This species is at present known from the south coast of Santa Clara Province, where it breaks up into a series of races on the various limestone blocks.

The animals of three of the subspecies were described by Bartsch as follows:

*Chondrothyrium violaceum violaceum*

Taken from a stone fence at La Pastora, 4 kilometers northwest of Trinidad.

Top of head buff, finely dotted with white; area about tentacles pale pink; tentacles coral red tipped with blue black; sides of body pale bluish smoky gray; sole of foot deeply cleft, a little paler than the sides of body.

*Chondrothyrium violaceum vigiaense*

Taken at La Vigia near Trinidad.

Top of head pale brown with a decided rosy flush; tentacles coral-red tipped with dusky brown; area about the base of tentacles a little paler than general ground color; snout pale buff at tip; sides smoke gray marked by numerous papillae, which are marked by many fine white dots; sole of foot a little paler than sides of body, deeply cleft.

*Chondrothyrium violaceum leteranense*

Specimens taken at San Juan de Leteran.

Top of head buff with rosy flush; snout and sides of body with olivaceous ground color upon which numerous papillae, each marked with many white dots, are disposed; tentacles varying in different individuals from dark orange to carmine red, paler at base and dusky at tip, the latter very slightly expanded; sole of foot smoke gray. In moving, the animal may carry its shell steadily or it may move it by lateral jerks.

KEY TO THE SUBSPECIES OF CHONDROTHYRIUM VIOLACEUM

Interrupted spiral bands of brown very strong

Truncated shell elongate-ovate----- *montanei*

Truncated shell ovate.

Axial riblets very fine and closely spaced----- *mortei*

Axial riblets not very fine and more widely spaced----- *vigiaense*

Interrupted spiral bands of brown not strong.

Interrupted spiral bands of brown of medium strength.

Tubercles on last whorl very strong----- clerchi

Tubercles on last whorl only moderately strong.

Tubercles of penultimate whorl very strong.

Decollated shell more than 17 mm----- leteranense

Decollated shell less than 14 mm----- fomentense

Tubercles of penultimate whorl not very strong.

Decollated shell elongate-ovate.

Decollated shell more than 18 mm----- violaceum

Decollated shell less than 15 mm----- tenue

Decollated shell ovate.

Spacing of axial ribs very regular----- manatiense

Spacing of axial ribs not very regular----- sopimpense

Interrupted spiral bands of brown feeble.

Tubercles rather coarse----- rocai

Tubercles not coarse----- maguasense

Interrupted spiral bands of brown not feeble.

Interrupted spiral bands of brown obsolete or absent.

Decollated shell elongate-ovate.

Decollated shell more than 20 mm long----- banaoense

Decollated shell less than 15 mm long----- ignotum

Decollated shell not elongate-ovate.

Decollated shell ovate.

Open umbilicus narrow.

Length of decollated shell more than 20 mm\_ gonzalesi

Length of decollated shell less than 17 mm.

Sculpture very fine----- atkinsi

Sculpture less fine----- serranum

Open umbilicus very wide.

Sculpture rough----- doloresi

Sculpture fine----- saugeti

#### CHONDROTHYRIUM VIOLACEUM GONZALES, new subspecies

##### PLATE 28, FIGURE 17

This race, which is probably the largest of the species, we have from Jagua Cienfuegos. The interrupted spiral bands are absent and the umbilicus is narrow; outer lip broadly expanded.

The type, U.S.N.M. no. 367820, has 4.2 whorls remaining and measures: Length, 20.6 mm; greater diameter, 13.7 mm; lesser diameter, 11.3 mm.

#### CHONDROTHYRIUM VIOLACEUM SERRANUM, new subspecies

##### PLATE 28, FIGURE 14

This race comes from Naranga Dulce, La Sierra, southeast of Cienfuegos. It resembles *C. v. atkinsi* in the absence of interrupted spiral bands but has finer tuberculation and is smaller.

The type, U.S.N.M. no. 367833, has 3.4 whorls remaining and measures: Length, 14.1 mm; greater diameter, 10.1 mm; lesser diameter, 8.0 mm.

**CHONDROTHYRIUM VIOLACEUM ATKINSI, new subspecies**

PLATE 28, FIGURE 15

This race comes from Soledad. It is a pale race of rather broadly ovate outline with comparatively narrow umbilicus, lacking the interrupted spiral bands. It is nearest to *C. v. serranum*, from which it can be readily distinguished by its more inflated whorls and finer tuberculation.

The type, U.S.N.M. no. 355048, has 4.3 whorls remaining and measures: Length, 19.4 mm; greater diameter, 11.8 mm; lesser diameter, 9.2 mm.

**CHONDROTHYRIUM VIOLACEUM DOLORESI, new subspecies**

PLATE 28, FIGURE 3

This race comes from between Guabairo and Dolores. It is of broadly ovate outline with widely open umbilicus, lacking the interrupted spiral bands of brown. It resembles *C. violaceum sangeti* but differs from this in having the shell heavier and the sculpture much coarser.

The type, U.S.N.M. no. 367826, has 3.5 whorls remaining and measures: Length, 12.0 mm; greater diameter, 10.4 mm; lesser diameter, 7.6 mm.

**CHONDROTHYRIUM VIOLACEUM VIOLACEUM (Pfeiffer)**

PLATE 28, FIGURE 19

1851. *Cyclostoma violaceum* PFEIFFER, Proc. Zool. Soc. London, 1851, pp. 245-246.

In this, the typical race, which we recognize in specimens from Trinidad and La Pastora, the shell is elongate-ovate, of yellowish buff color, with moderately strong interrupted spiral bands of brown. Here the tubercles on the penultimate whorl are not strong but correspond to those of the preceding turns.

The specimen described and figured, U.S.N.M. no. 104493, has 4.5 whorls remaining and measures: Length, 20.0 mm; greater diameter, 12.1 mm; lesser diameter, 9.7 mm.

**CHONDROTHYRIUM VIOLACEUM MORTEI, new species**

PLATE 28, FIGURE 4

This race, which was collected by Dr. de la Torre, comes from Nazimiento del Rio Caballero, near Trinidad. It has the whorls a

little more inflated than *C. violaceum vigiaense* and the axial and spiral sculpture finer, more numerous and closer spaced. The dark spiral bands are also a little lighter.

The type, U.S.N.M. no. 367828, has a little more than three whorls remaining, and measures: Length, 17.0 mm; greater diameter, 11.7 mm; lesser diameter, 9.7 mm.

**CHONDROTHYRIUM VIOLACEUM VIGIAENSE, new subspecies**

**PLATE 28, FIGURE 1**

This race comes from La Vigia near Trinidad. The truncated shell is of ovate outline and the coloration is very dark, tending to purplish on the last turn. The elements composing the broad interrupted spiral bands are arranged in axial series. The tips of the tubercles are white and stand out markedly against the dark background. The outer lip is also decidedly expanded on all sides. For comparison with *C. violaceum montaneï*, see the diagnosis of that subspecies.

The type, U.S.N.M. no. 493282, has a little more than four whorls remaining and measures: Length, 18.8 mm; greater diameter, 12.5 mm; lesser diameter, 10.1 mm.

**CHONDROTHYRIUM VIOLACEUM LETERANENSE, new species**

**PLATE 28, FIGURE 2**

This race comes from San Juan de Leteran. Here the shell is elongate-conic and the tubercles on both the last and penultimate whorls are decidedly strong, in which respect it resembles *C. violaceum fomentense*, from which its larger size and more elongate form will readily distinguish it. The ground color is buff, and the interrupted spiral bands of brown are only of medium strength.

The type, U.S.N.M. no. 367832, has 5 whorls remaining and measures: Length, 17.8 mm; greater diameter, 11.4 mm; lesser diameter, 8.3 mm.

**CHONDROTHYRIUM VIOLACEUM MAGUASENSE, new subspecies**

**PLATE 28, FIGURE 7**

This race comes from the Magua Valley of Trinidad. It is a small pale race with feeble interrupted spiral bands of brown, in which respect it resembles *C. violaceum rocai*, from which it differs by its much finer tubercles and less inflated whorls.

The type, U.S.N.M. no. 367824, has 4 whorls remaining and measures: Length, 11.3 mm; greater diameter, 7.8 mm; lesser diameter, 6.2 mm.

**CHONDROTHYRIUM VIOLACEUM MANATIENSE, new subspecies**

## PLATE 28, FIGURE 12

This race comes from Loma del Marin, Rio Manati, Trinidad. It is a small race with the whorls decidedly inflated, of buff color, with the interrupted spiral bands of brown weakly developed but having their elements also in axial series. It resembles most closely *C. violaceum sopimpense*, from which it can be distinguished by its more inflated whorls and more regularly distributed axial ribs.

The type, U.S.N.M. no. 367821, has 4 whorls remaining and measures: Length, 14.6 mm; greater diameter, 9.5 mm; lesser diameter, 6.9 mm.

**CHONDROTHYRIUM VIOLACEUM SOPIMPENSE, new subspecies**

## PLATE 28, FIGURE 11

This race comes from Sopimpa, which is on the railway between Fomento and Trinidad. Here the shell is also buff color, with a purplish flush. The interrupted spiral bands are moderately strong, the whorls are inflated, and the axial ribs are rather irregular in distribution, as well as in strength, a character that will readily distinguish it from *C. violaceum manatiense*.

The type, U.S.N.M. no. 355046, has 4.2 whorls remaining and measures: Length, 13.7 mm; greater diameter, 9.3 mm; lesser diameter, 7.0 mm.

**CHONDROTHYRIUM VIOLACEUM FOMENTENSE, new subspecies**

## PLATE 28, FIGURE 8

This small race comes from Fomento, northeast of Trinidad. Here the early whorls are decidedly darker than the last. The sculpture on the penultimate whorl is very heavy, in which respect it resembles *C. violaceum leteranense*, from which, however, it can readily be distinguished by its small size.

The type, U.S.N.M. no. 367822, has 4 whorls remaining and measures: Length, 13.5 mm; greater diameter, 8.8 mm; lesser diameter, 6.8 mm.

**CHONDROTHYRIUM VIOLACEUM CLERCHI, new subspecies**

## PLATE 28, FIGURE 13

This subspecies was collected by Clerch at Quemado Feo. It is a small ovate race of flesh-colored ground color, with the interrupted spiral bands of brown only of medium strength. The axial riblets

are rather distantly spaced, and the tubercles of the last whorl consequently have a decidedly strong aspect.

The type, U.S.N.M. no. 367827, has a little more than 4 whorls remaining and measures: Length, 15.6 mm; greater diameter, 11.0 mm; lesser diameter, 8.4 mm.

CHONDROTHYRIUM VIOLACEUM MONTANEI, new subspecies

PLATE 28, FIGURE 20

This race was collected by Hermanos Leon and Roca at Rosa de Gavilanes in the Sierra de Cabillete. It is a large race of elongate-ovate outline, of yellowish buff ground color, with slender, well-marked, interrupted spiral bands of brown whose elements are also arranged in axial series. In the strength of the color marking this race approximates *C. violaceum vigiaense* but is readily distinguished from this by its much more elongate form and much paler coloration.

The type, U.S.N.M. no. 367823, has 4 whorls remaining and measures: Length, 20.8 mm; greater diameter, 12.9 mm; lesser diameter, 10.5 mm.

CHONDROTHYRIUM VIOLACEUM ROCAI, new subspecies

PLATE 28, FIGURE 5

This race comes from the valley of the Rio Caracusey, Sancti Spiritus. It is a small race of ovate outline, having the interrupted spiral bands of brown very feeble, in which it agrees with *C. violaceum maguasense*, from which, however, its much more inflated whorls and coarser tubercles will readily distinguish it. The coloration is dark and the outer lip very strong.

The type, U.S.N.M. no. 367830, has 4.1 whorls remaining and measures: Length, 11.7 mm; greater diameter, 8.2 mm; lesser diameter, 6.5 mm.

CHONDROTHYRIUM VIOLACEUM BANAENSE, new subspecies

PLATE 28, FIGURE 18

This large race comes from Banao southwest of Sancti Spiritus. It has fine axial riblets of elongate-ovate outline, with the interior brown and the lip white. It resembles *C. violaceum ignotum* but is at once distinguished from it by its large size and darker interior coloration.

The type, U.S.N.M. no. 367831, has 5 whorls remaining and measures: Length, 20.1 mm; greater diameter, 14.1 mm; lesser diameter, 10.7 mm.

## CHONDROTHYRIUM VIOLACEUM TENUE, new subspecies

## PLATE 28, FIGURE 9

This small race comes from Loma de Banao. Its shell is elongate-ovate, the early whorls being a little darker than the rest. Interrupted spiral bands only moderately strong. The sculpture of the penultimate whorl is no stronger than that of the preceding turn. The outer lip is also only moderately expanded. It differs from *C. violaceum violaceum* in being much smaller.

The type, U.S.N.M. no. 355050, has 4 whorls remaining and measures: Length, 14.7 mm; greater diameter, 9.0 mm; lesser diameter, 6.8 mm.

## CHONDROTHYRIUM VIOLACEUM IGNOTUM, new subspecies

## PLATE 28, FIGURE 10

With this race we have no definite locality. The shell is pale yellowish white, elongate-ovate, and the interrupted spiral bands are absent. It suggests *C. violaceum banaoense* but is very small in comparison.

The type, U.S.N.M. no. 315184, has 3.3 whorls remaining and measures: Length, 13.7 mm; greater diameter, 9.2; lesser diameter, 7.0 mm.

## CHONDROTHYRIUM VIOLACEUM SAUGETI, new subspecies

## PLATE 28, FIGURE 6

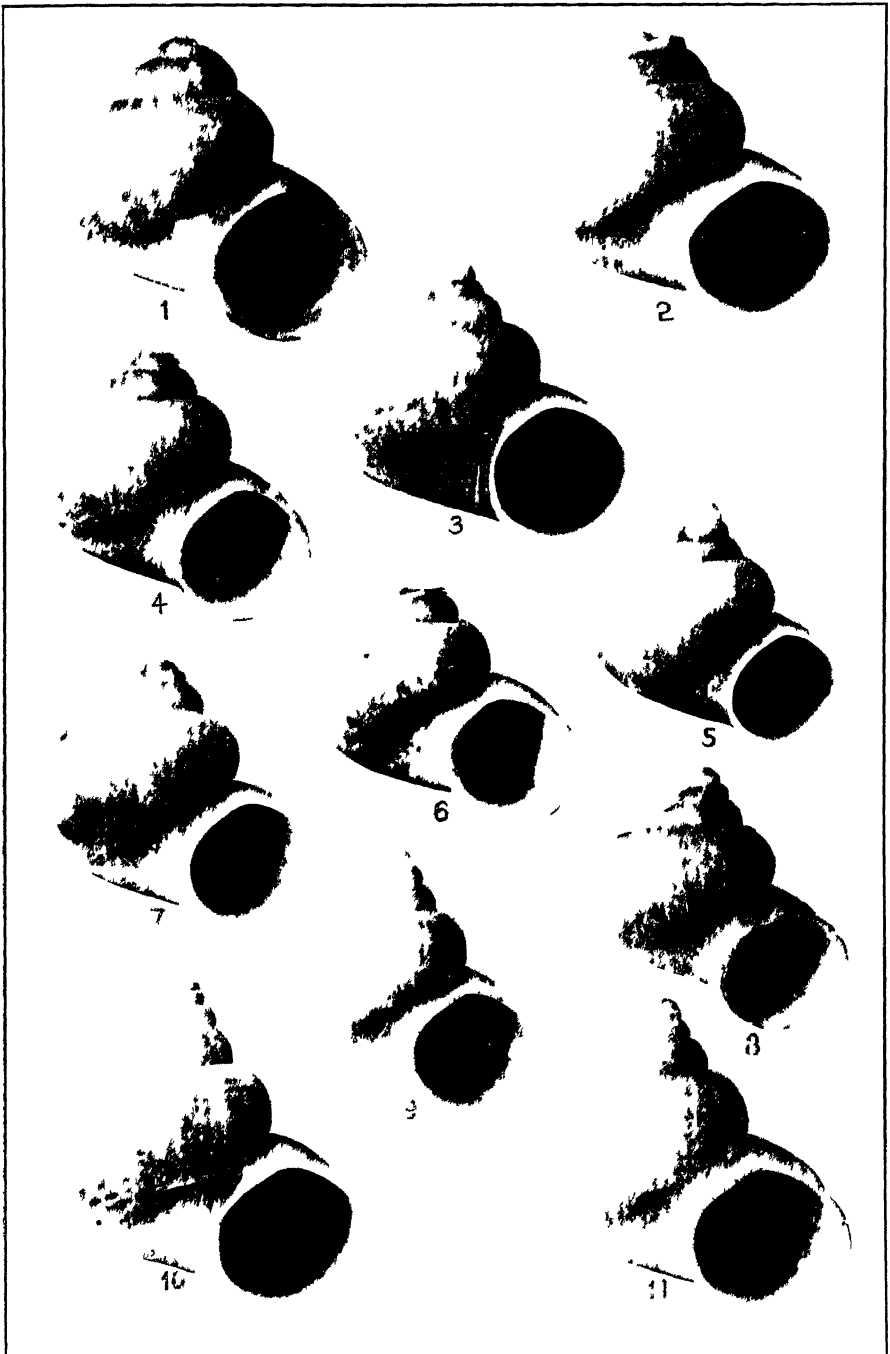
This race comes from San José northeast of Sancte Spiritus. It is a thin-shelled, broadly ovate race, with very fine sculpture and with the outer lip poorly developed. It resembles most closely *C. violaceum doloresi*, from which its more ovate shell and finer sculpture will readily distinguish it.

The type, U.S.N.M. no. 367834, has 3.8 whorls remaining and measures: Length, 12.2 mm; greater diameter, 9.8 mm; lesser diameter, 7.0 mm.



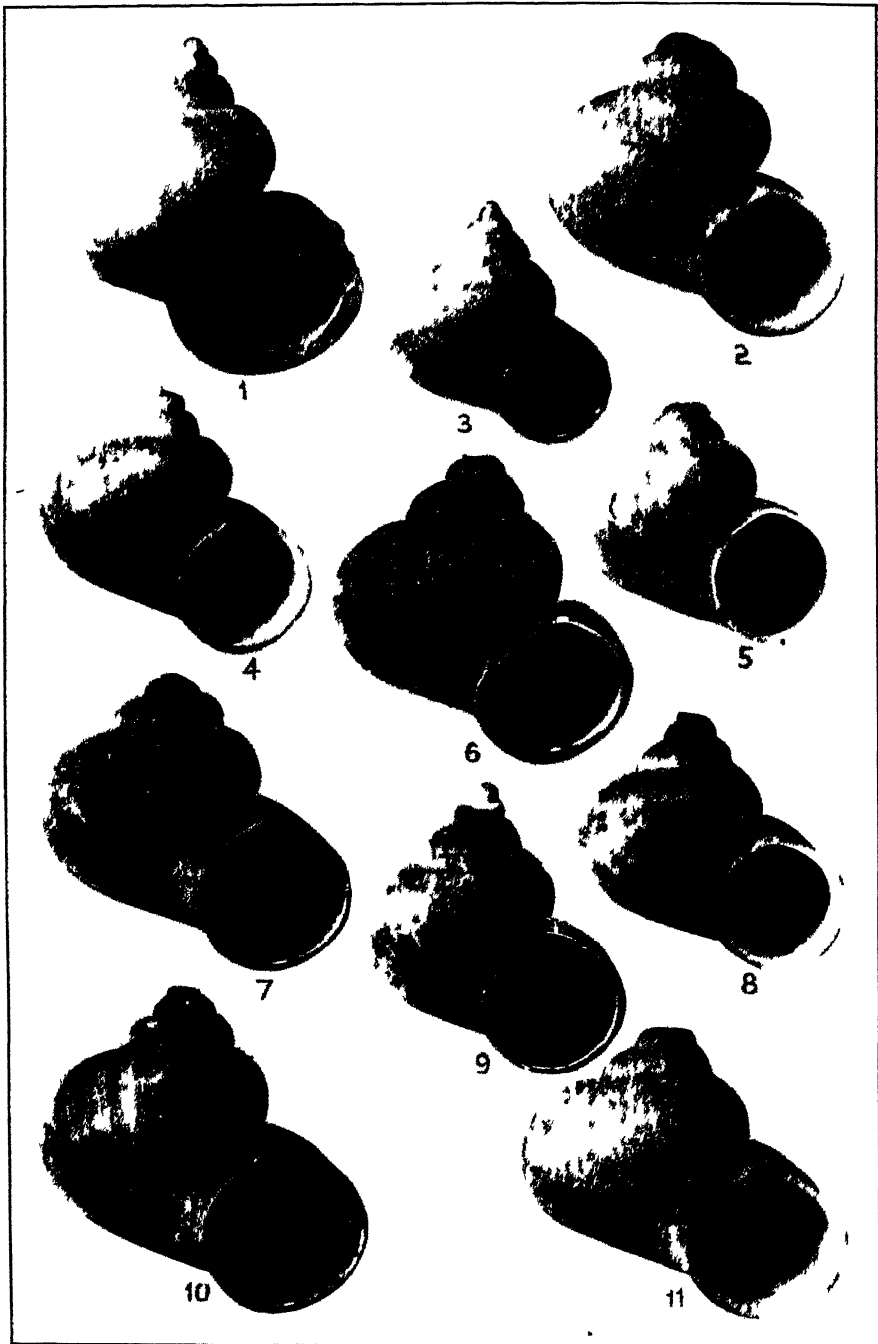






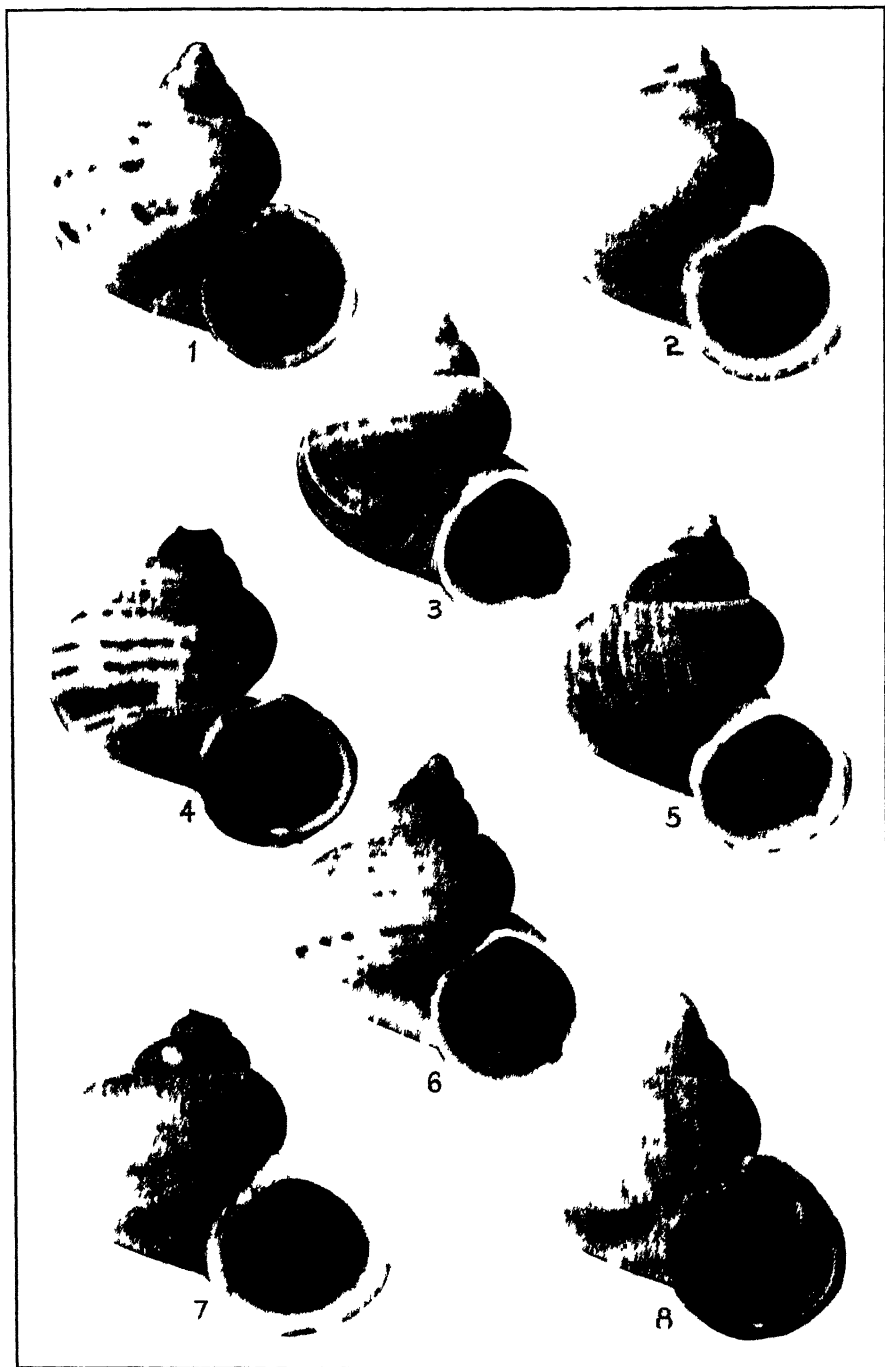
SUBSPECIES OF CHONDROPOMETES (CHONDROPOMETES) VIGNAENSE (X2)

1, *azucarensis* 2, *pydaei* 3, *poenitensis* 4, *caponensis* 5, *martillensis* 6, *azucarellum* 7, *celadensis* 8, *vignaensis*,  
 9 *puerteculensis* 10, *brunoeocinctum* 11, *clappi*



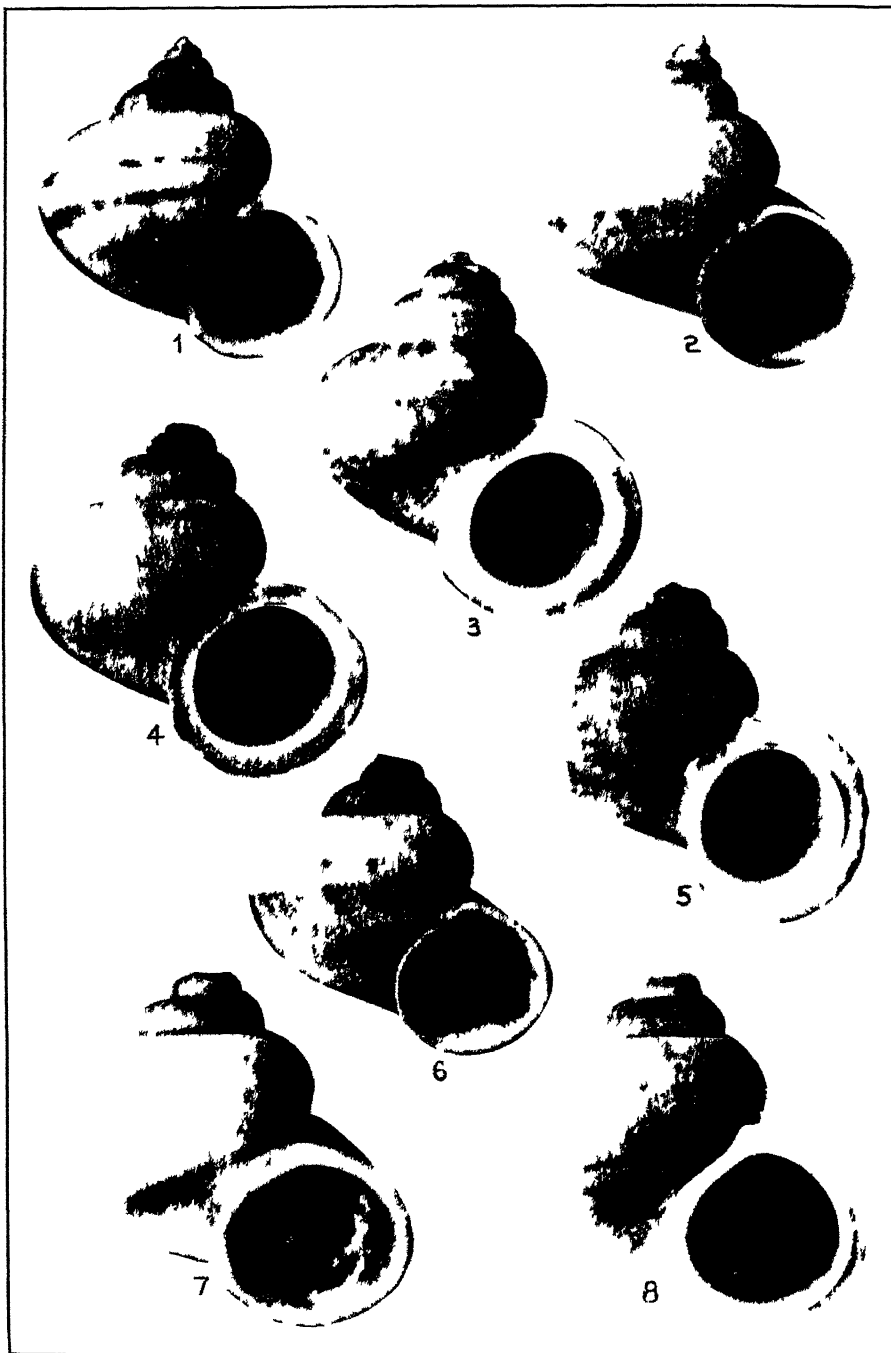
SPECIES AND SUBSPECIES OF CHONDROPOMETES (CHONDROPOMETES) (X2)

- 1 *latilabre* 2 *signalense lucifer* 3 *torrei gratiosum* 4 *i fogonense* 5 *i palmaritense* 6 *t flammulibre* 7 *i infernale* 8 *i parucense* 9 *t antonitense* 10 *i ignicolor* 11 *i tenerabile*



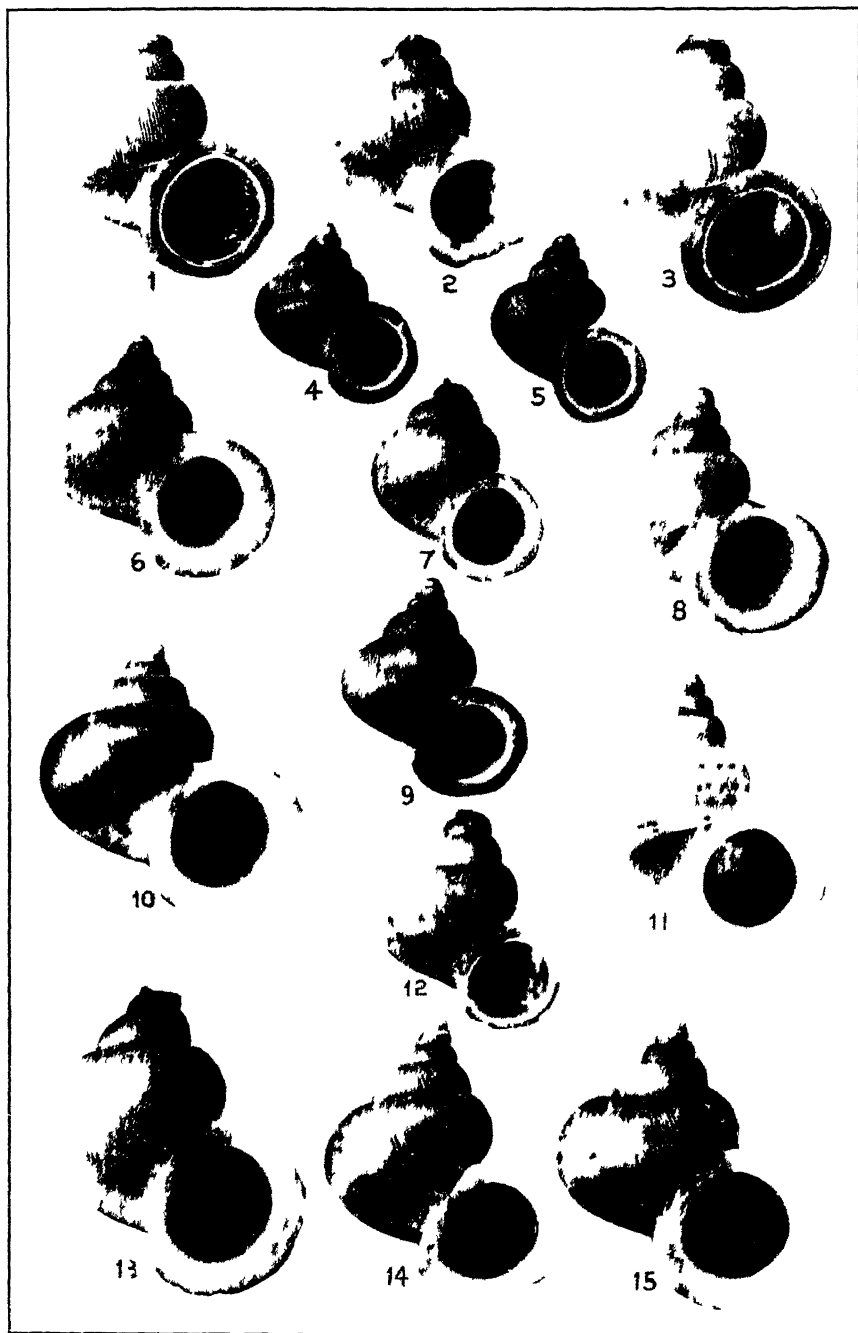
SUBSPECIES OF *CHONDROPOMETES (CHONDROPOMETES) TORREI* (X2)

1 *pallidulum* 2 *rincondense* 3 *collimelire* 4 *cingulatum* 5 *jajuaense* 6 *flavum* 7 *minense* 8 *torrei*



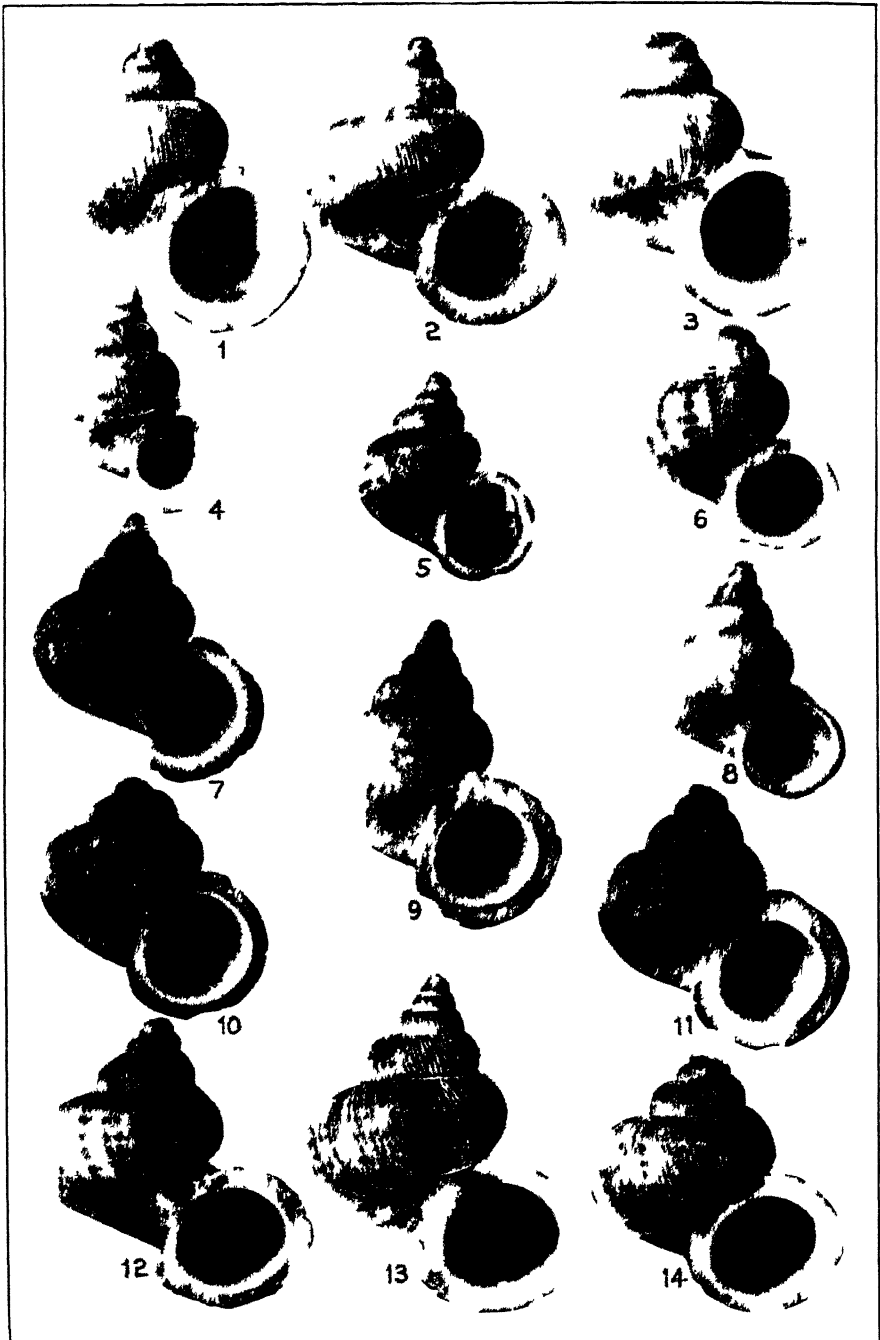
SPECIES AND SUBSPECIES OF THE SUBGENERA CHONDROPOMETES AND CHONDROTHYROMA (X2)

1 (*Chondropometes*) *torrei* affinis 2 (*C*) *t. alvare* 3, (*Chondrothyroma*) *eximium* *mallacatum* 4 (*C*) *e. eximium*  
 5 (*C*) *e. angusticolum* 6 (*Chondropometes*) *torrei* *luteilabre* 7 (*C*) *t. antoniense* 8 (*C*) *t. v. aturatum*



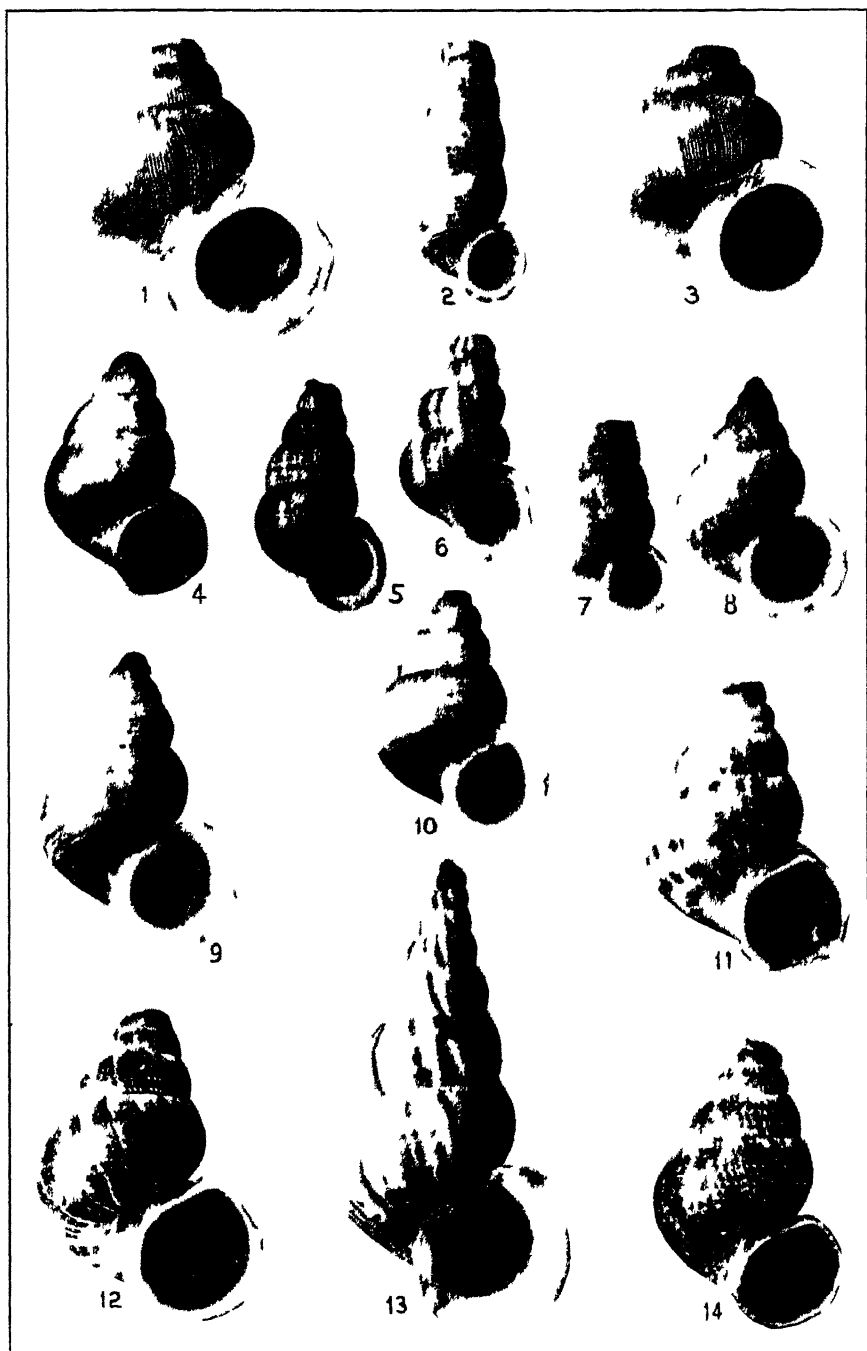
## SPECIES AND SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) (X2)

- 1 *sagebumi sagebumi* 2 *di punctum* 3 *s mendoense* 4 *color fontei* 5 *s pirum* 6 *color* 7 *c carnicolor* 8 *c magister* 9 *c sp* 10 *bellissimum* 11 *exiguum notatum* 12 *s portale ense* 13 *c cerium* 14 *c exquisitum* 15 *c punctolineatum*



## SPECIES AND SUBSPECIES OF CHONDROPOMETES (CHONDROTHYROMA) (X2)

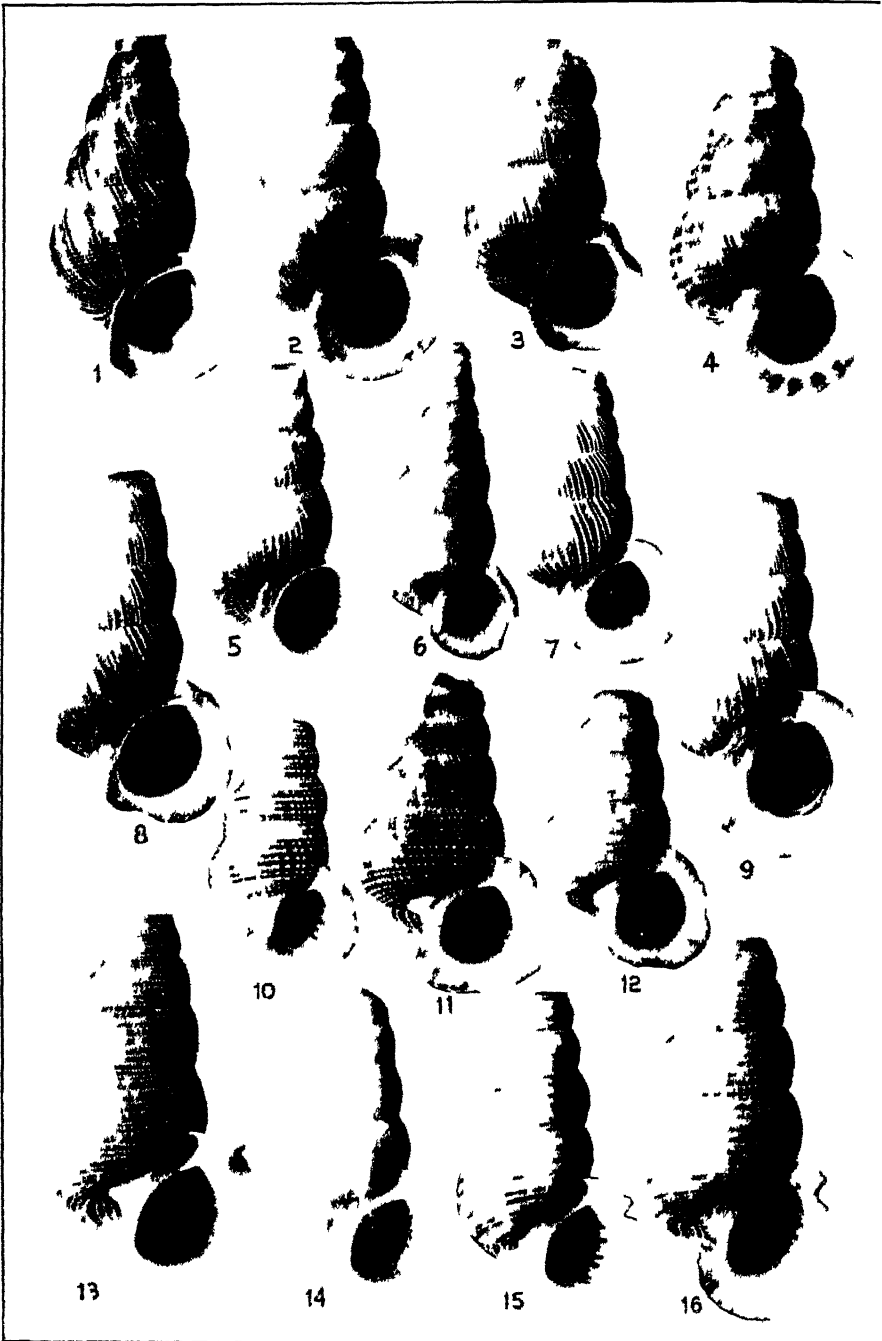
- 1 *egregium* taller 2 *elipense* 3 *se lajunitense* 4 *se egregium* 5 *se paradium* 6 *se loureanu*  
 7 *scopulorum perplerum* 8 *se mameji* 9 *se aranjoi* 10 *se cunbren* 11 *se scopulorum* 12 *majnum*  
 13 *elisabethae* 14 *n. n. n.*



SPECIES AND SUBSPECIES OF CHONDROPOMETES TURRITHYRA AND HENDERSONINA (X2)

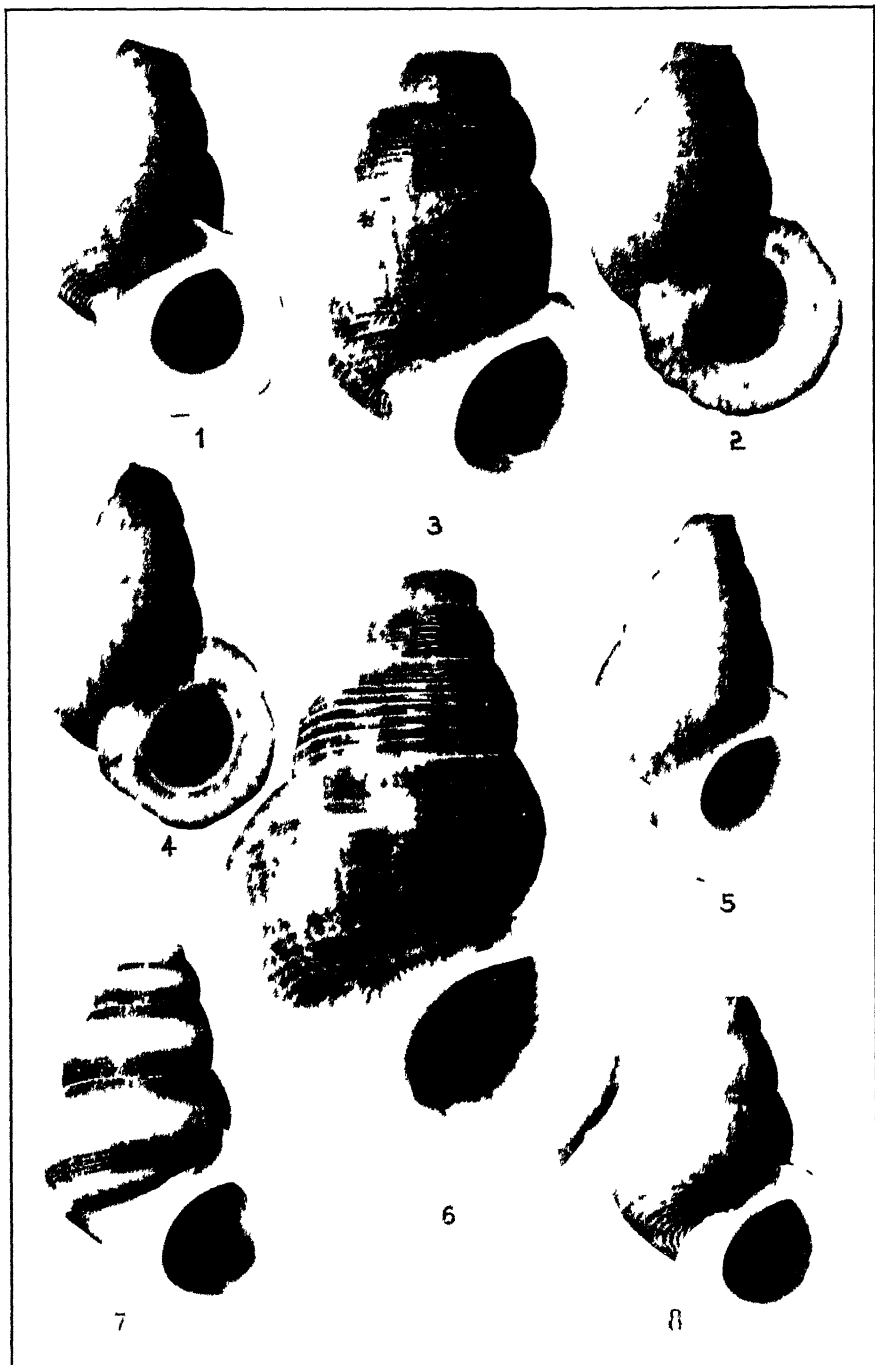
- 1 *Chondropometes (Chondrothyroma) saccharinum rubicollum* 2 *Turriturina (Turriturina) lermi* de 3 *C. (Chondrothyroma) saccharinum saccharinum* 4 *Hendersonina (Scobinapoma) enrala* 5 *Turriturina (Turriturina) hamlini hamlini* 6 *T. (T.) h. cerroensis* 7 *T. (T.) h. zuluensis* 8 *Hendersonina (Hendersonina)*





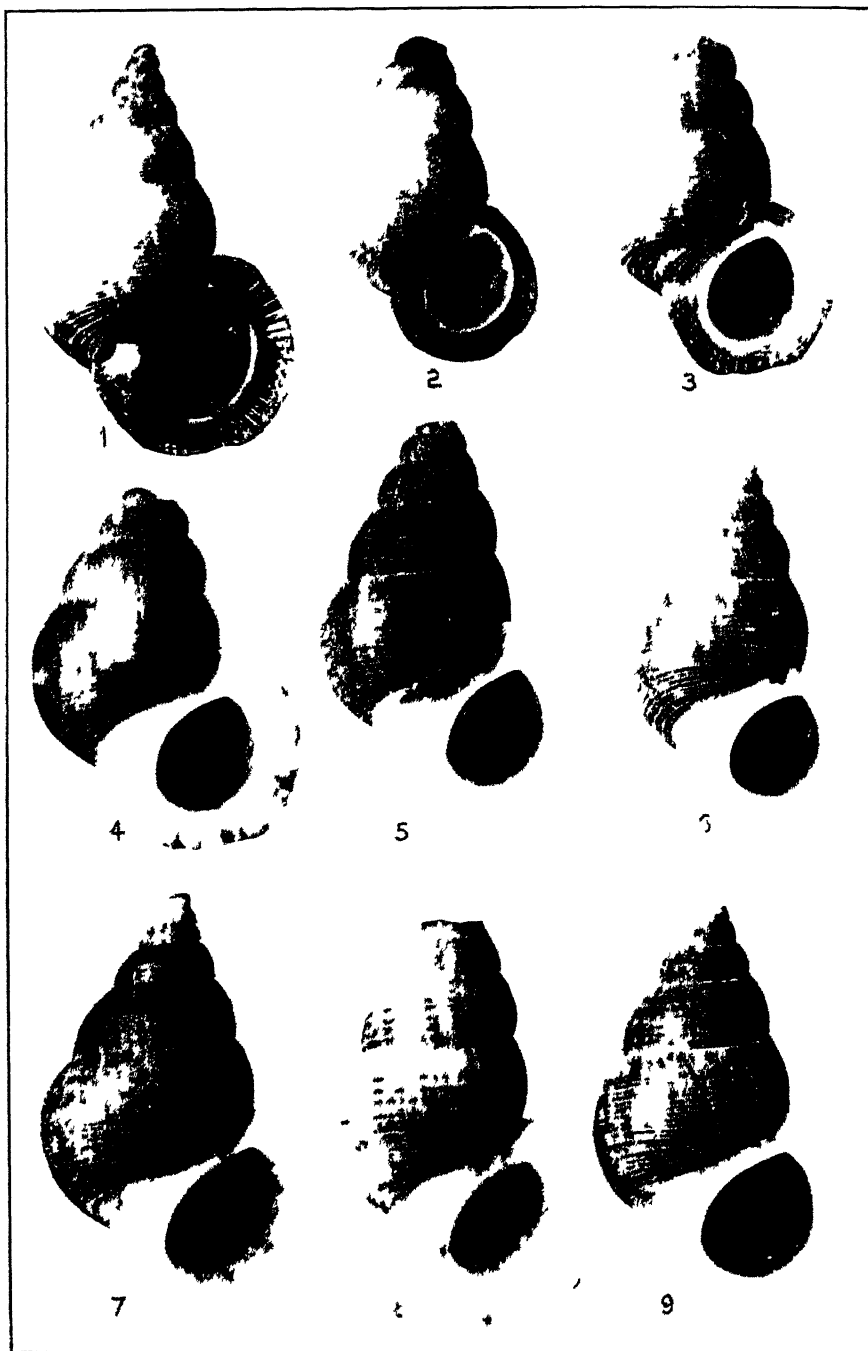
SPECIES AND SUBSPECIES OF TURRITHYRA (X2)

- 1 *Turrithyra (Turrithyra) canaliculata pinaltensis* 2 *T. (T.) canaliculata* 3 *T. (T.) canaliculata* 4 *T. (T.) canaliculata* 5 *T. (T.) deceptor scalaris* 6 *T. (T.) deceptor sinuosa rhachitica* 7 *T. (T.) deceptor sinuosa rhachitica* 8 *T. (T.) deceptor sinuosa rhachitica* 9 *T. (T.) deceptor sinuosa rhachitica* 10 *T. (T.) deceptor sinuosa rhachitica* 11 *T. (T.) deceptor sinuosa rhachitica* 12 *T. (T.) deceptor sinuosa rhachitica* 13 *T. (T.) deceptor sinuosa rhachitica* 14 *T. (T.) deceptor sinuosa rhachitica* 15 *T. (T.) deceptor sinuosa rhachitica* 16 *T. (T.) deceptor sinuosa rhachitica*



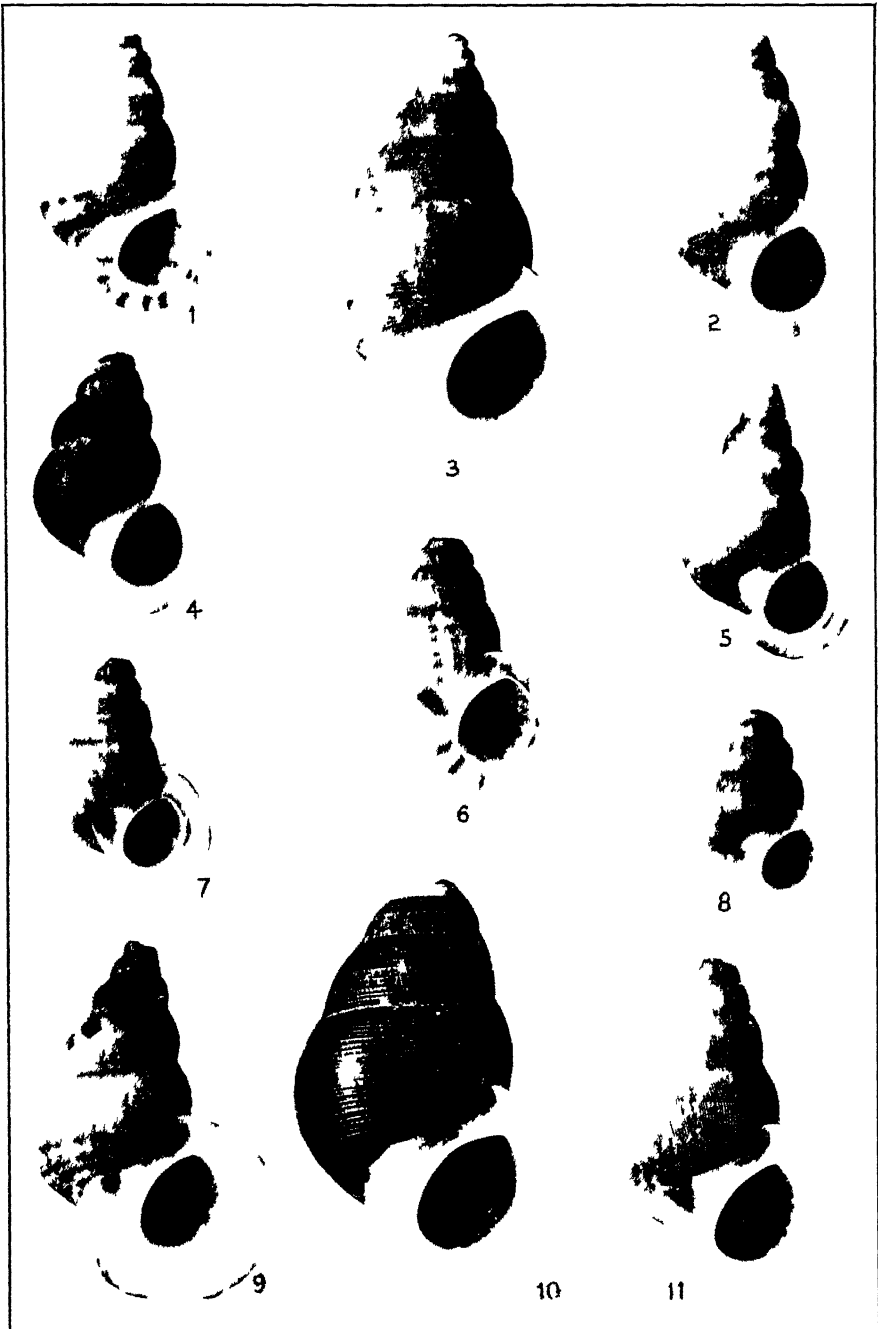
## SPECIES AND SUBSPECIES OF CHONDROTHYRA (X2)

- 1 *Chondrothyra* (*Chondrothyra*) *tosta aurantia* 2 *C* (*C*) *t* *tosta* 3 *C* (*Plicathyra*) *crassa* 4 *C* (*C*) *tosta hes-*  
*peria* 5 *C* (*C*) *t* *lactea* 6 *C* (*Hendersonoma*) *percrassa* 7 *C* (*C*) *t* *to ta* 8 *C* (*C*) *t* *perfo ta*



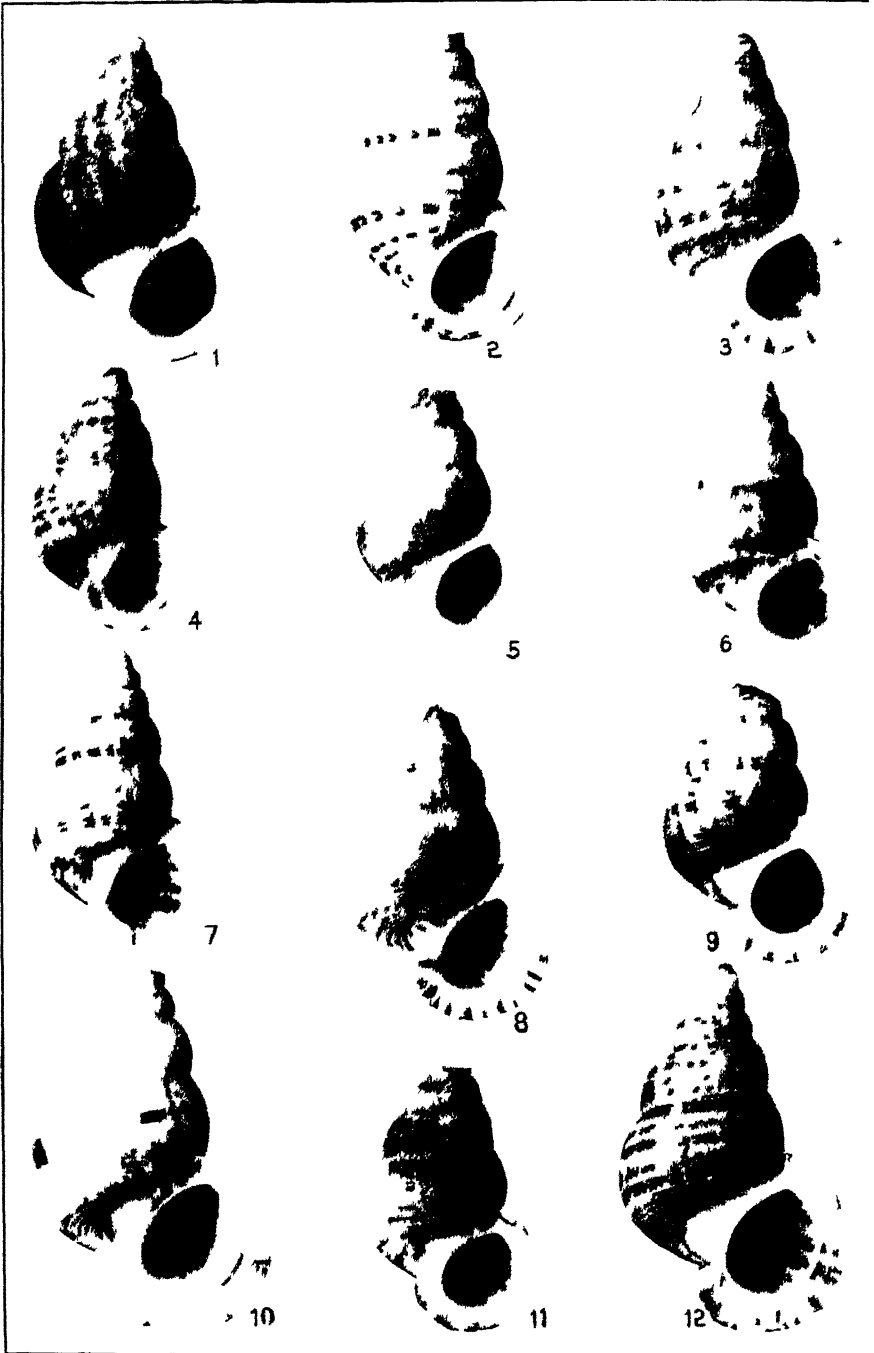
## SPECIES AND SUBSPECIES OF CHONDROTHYRA (X2)

- 1 *Chondrothyra* (*Chondrothyra*) *atrismata atrismata* 2 *C. (C.) a. luctuosa* 3 *C. (C.) a. umbrata* 4 *C. (C.) subegregia subegregia* 5 *C. (C.) s. paterna* 6 *C. (Plicothyra) uniplicata* 7 *C. (C.) egregia* 8 *C. (P.) u. righti* 9 *C. (C.) egregia*



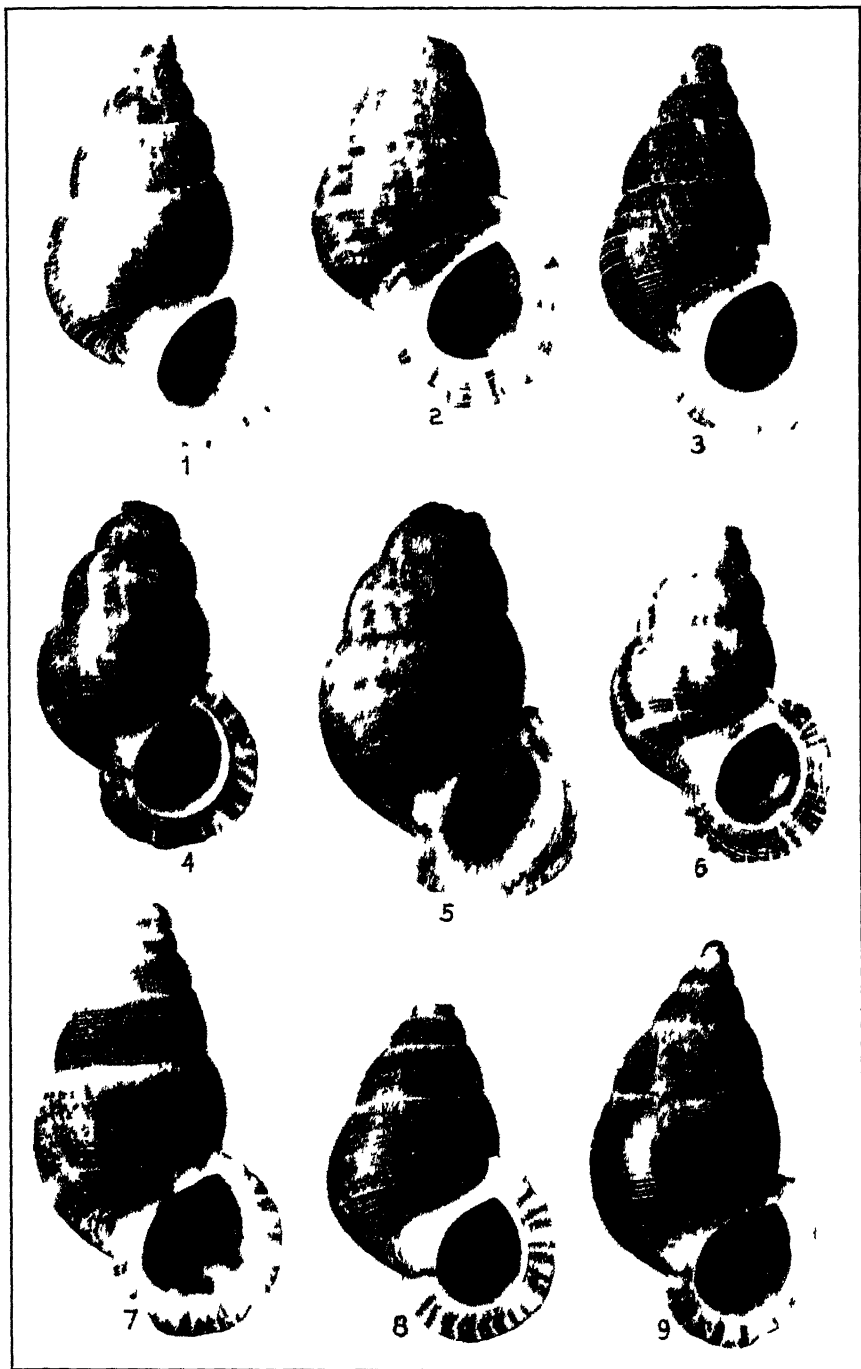
## SPECIES AND SUBSPECIES OF CHONDROTHYRETES AND CHONDROTHYRA (X2)

- 1 *Chondrothyretes delectabilis delectabilis* 2 *C. d. bellamaria* 3 *Chondrothyra (Chondrothyra) rutila rutila*  
 4 *Chondrothyretes d. amabili* 5 *C. d. palmaris* 6 *Chondrothyra (Isorothyra) eumbrensis eumbrensis* 7  
*C. (I.) e. catharina* 8 *C. (I.) natalensis* 9 *C. (I.) foata foata* 10 *C. (Chondrothyra) rutila nebulosa*  
 11 *C. (I.) foata toroensis*



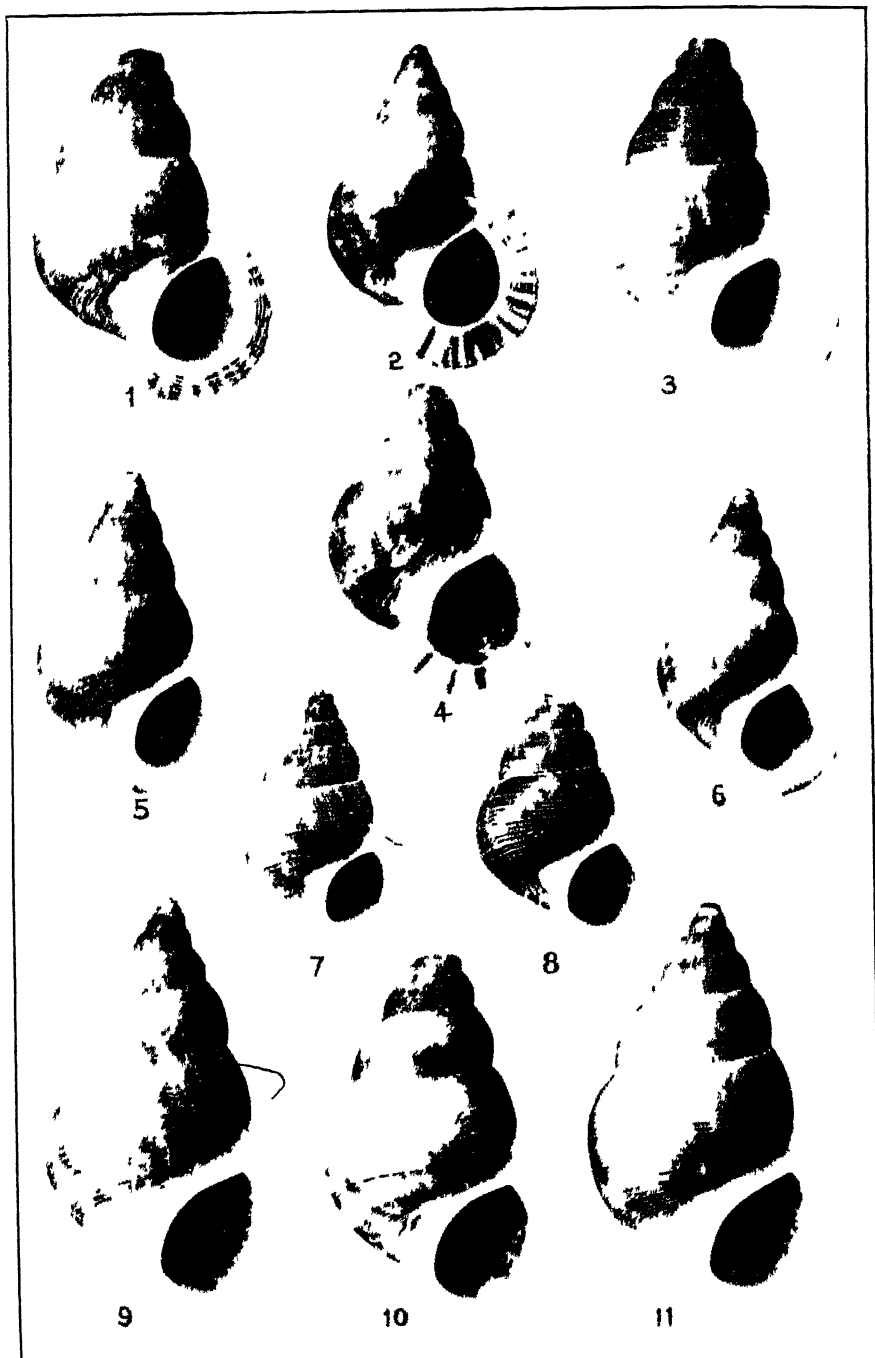
SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

1 *impreata* 2 *ornata* 3 *solacia* 4 *peregrina* 5 *rosari* 6 *alba* 7 *shuttleworthi* 8 *perplea* 9 *mameyensis* 10 *atalmensis* 11 *giamen* 12 *preata* 13 *gintea*



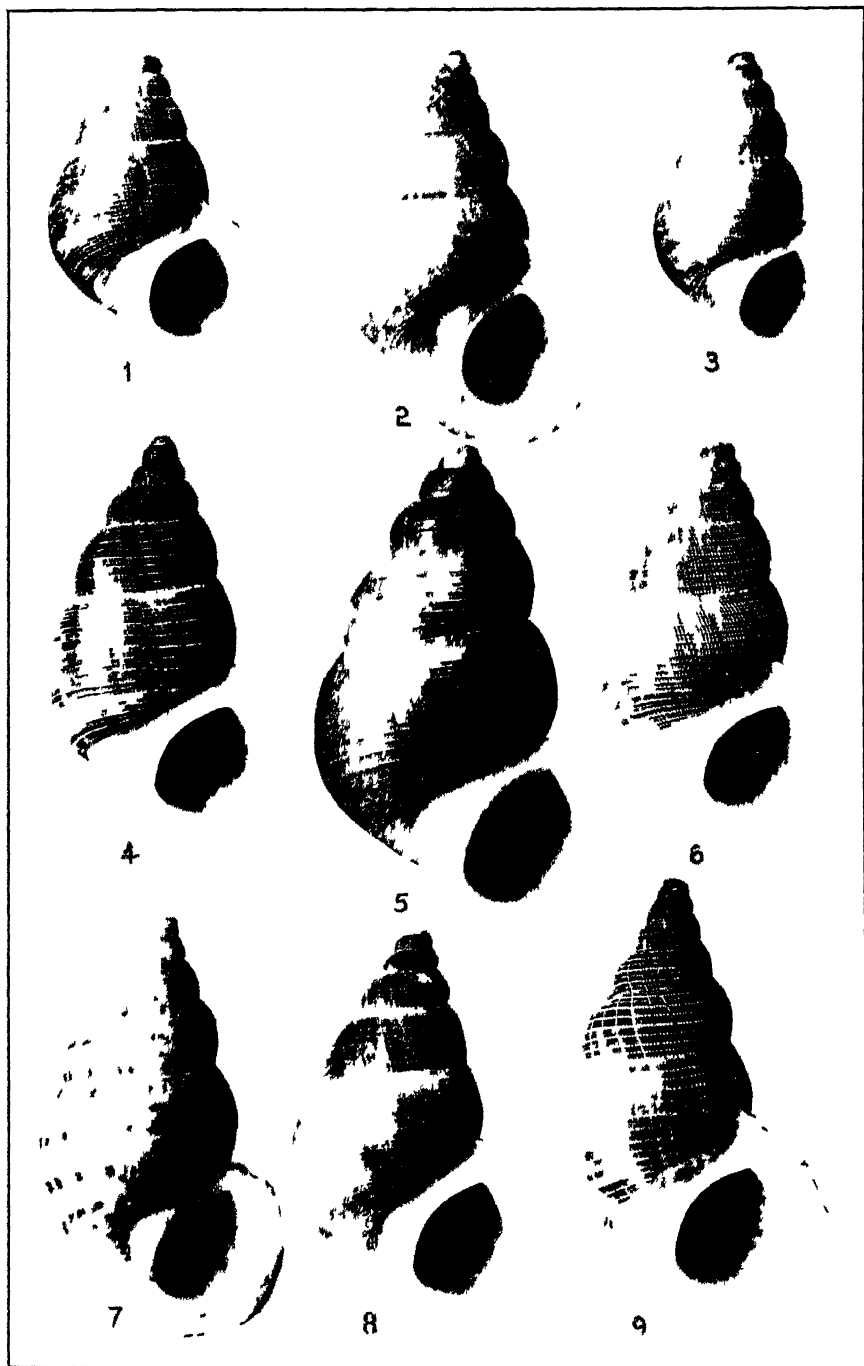
SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

- 1 *tenebrata tenebrata* 2 *t. scripta* 3 *t. montaliensis* 4 *shuttleworthi clivicola* 5 *s. cumbrensis* 6 *t. crinalensis*  
7 *s. portica* 8 *s. atriola* 9 *s. shuttleworthi*



## SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

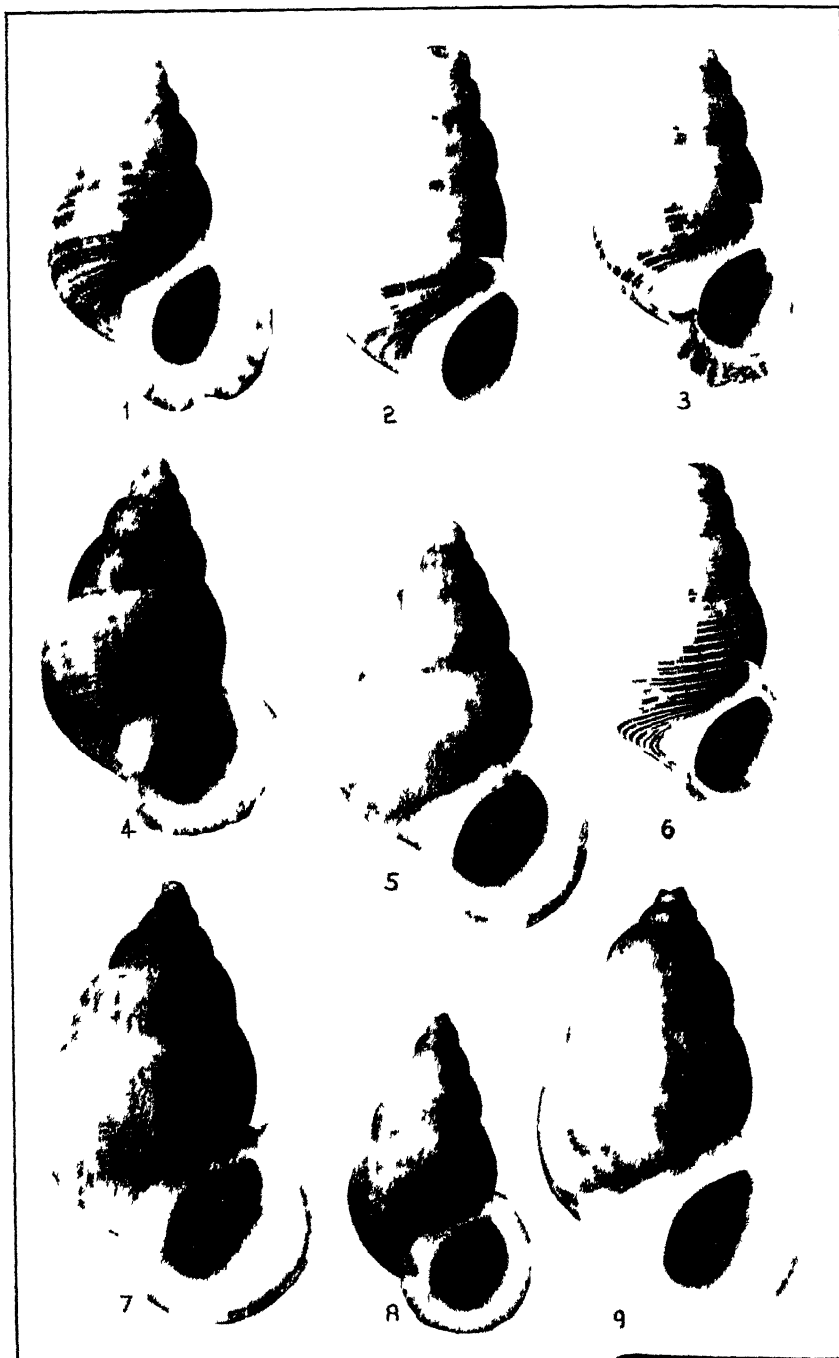
- 1, *tenebrata ayuensis* 2, *t. brevior* 3, *t. albolabris* 4, *t. variabilis* 5, *reticulata petricolella* 6, *r. pellucida* 7, *r. reticulella* 8, *r. fratercula* 9, *r. petricola* 10, *r. galeren* 11, *r. fraterna*



## SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

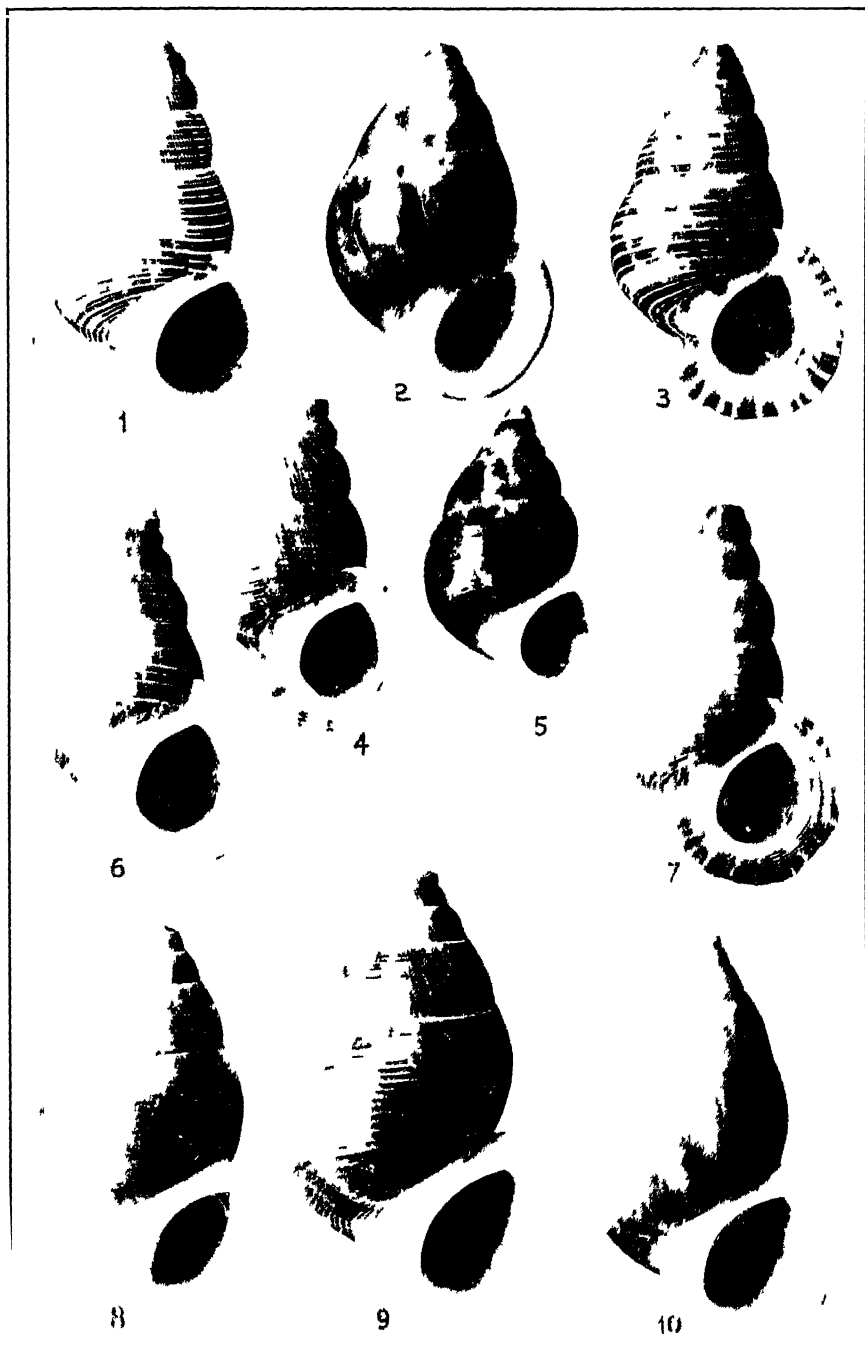
1 *reticulata* 2 *encrinurella* 3 *r. scrobicula* 4 *r. versicolor* 5 *birbourni* 6 *birbourni* 7 *reticulata*  
 " *b. itineraria* 8 *r. co. lanerensis* 9 *r. affinis*





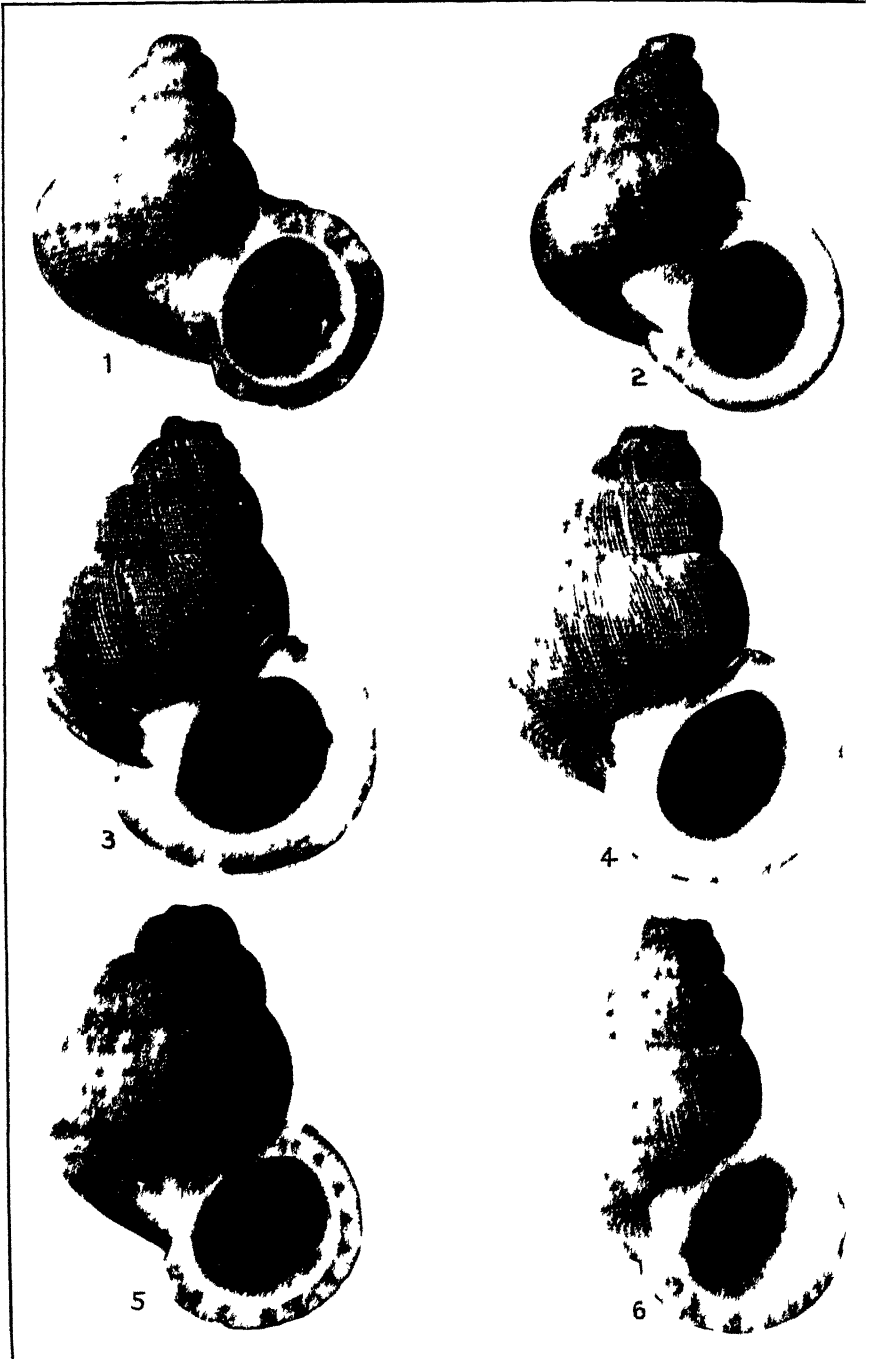
SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

- 1 *gundlachi porticola* 2 *g. murallensis* 3 *g. guanensis* 4 *g. devata* 5 *incrassata aurantiaci* 6 *g. gundlachi*  
 7 *incrassata* 8 *fumata* 9 *subincrassata*



## SPECIES AND SUBSPECIES OF CHONDROTHYRETES (X2)

- 1 *parvis scalaris* 2 *cerina polita* 3 *p. parvis* 4 *p. fossularis* 5 *c. puella* 6 *p. sinensis* 7 *p. amoenus* 8 *c. subcerina* 9 *c. ro. coarctata* 10 *c. cerina*



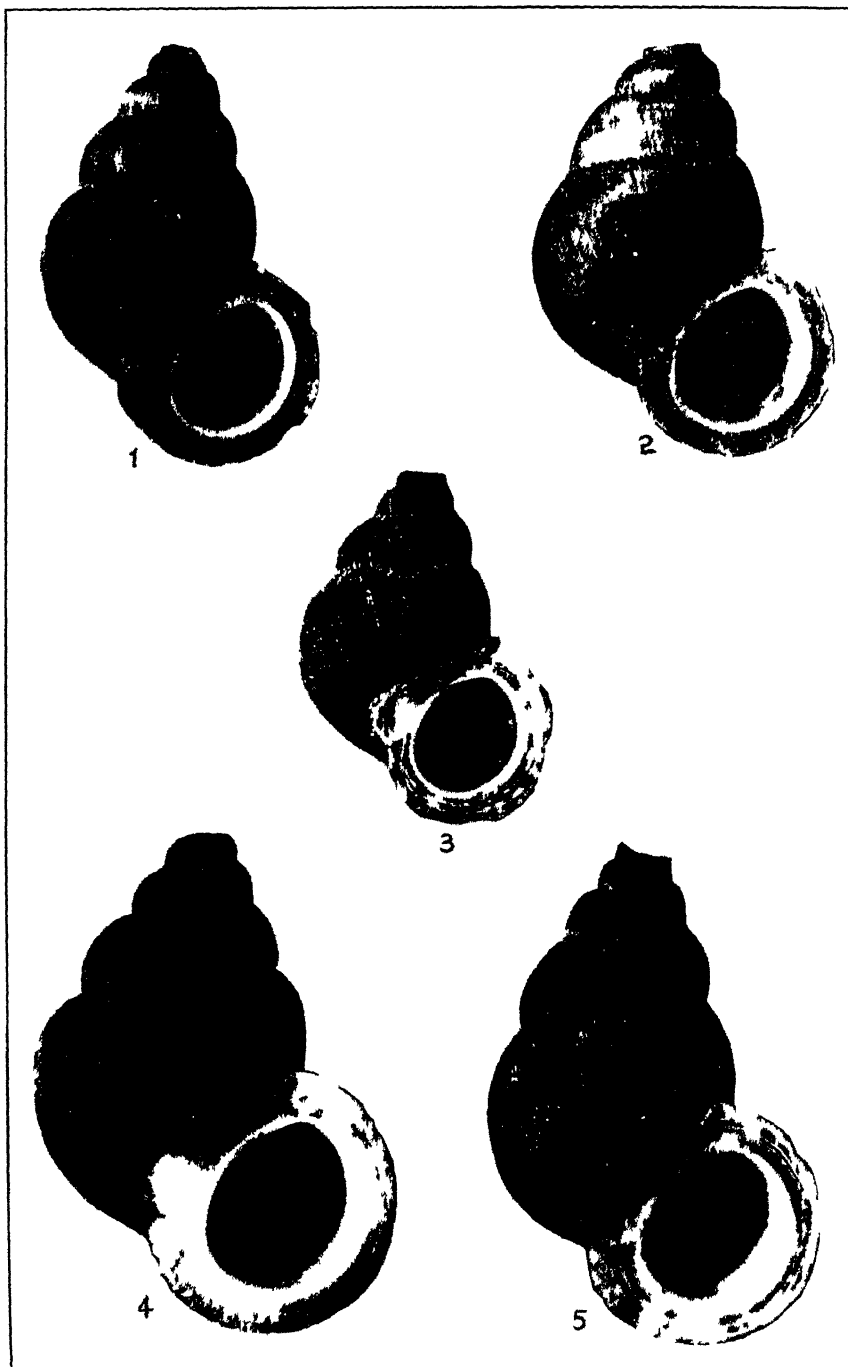
SPECIES AND SUBSPECIES OF CHONDROTHYRELLA (CHONDROTHYRELLA) (X4)

1, *erici* 2 *perturbata* 3 4 *pudica* 5 *cuzcoensis* 6 *caroli* 6 *cuzcoensis*



SUBSPECIES OF *CHONDROTHYRELLA* (*PLICATHYRELLA*) *ASSIMILIS* (X4)

1 *assimilis* 2 *maecoi* 3 *gemma* 4 *guirensis* 5 *abronensis* 6 *cisnero* 7 *signata*



SPECIES AND SUBSPECIES OF CHONDROTHYRELLA (CHONDROTHYRELLA) (X4)

1 *petricosa* 2 *petricosa* 3 *petricosa* 4 *petricosa* 5 *petricosa*



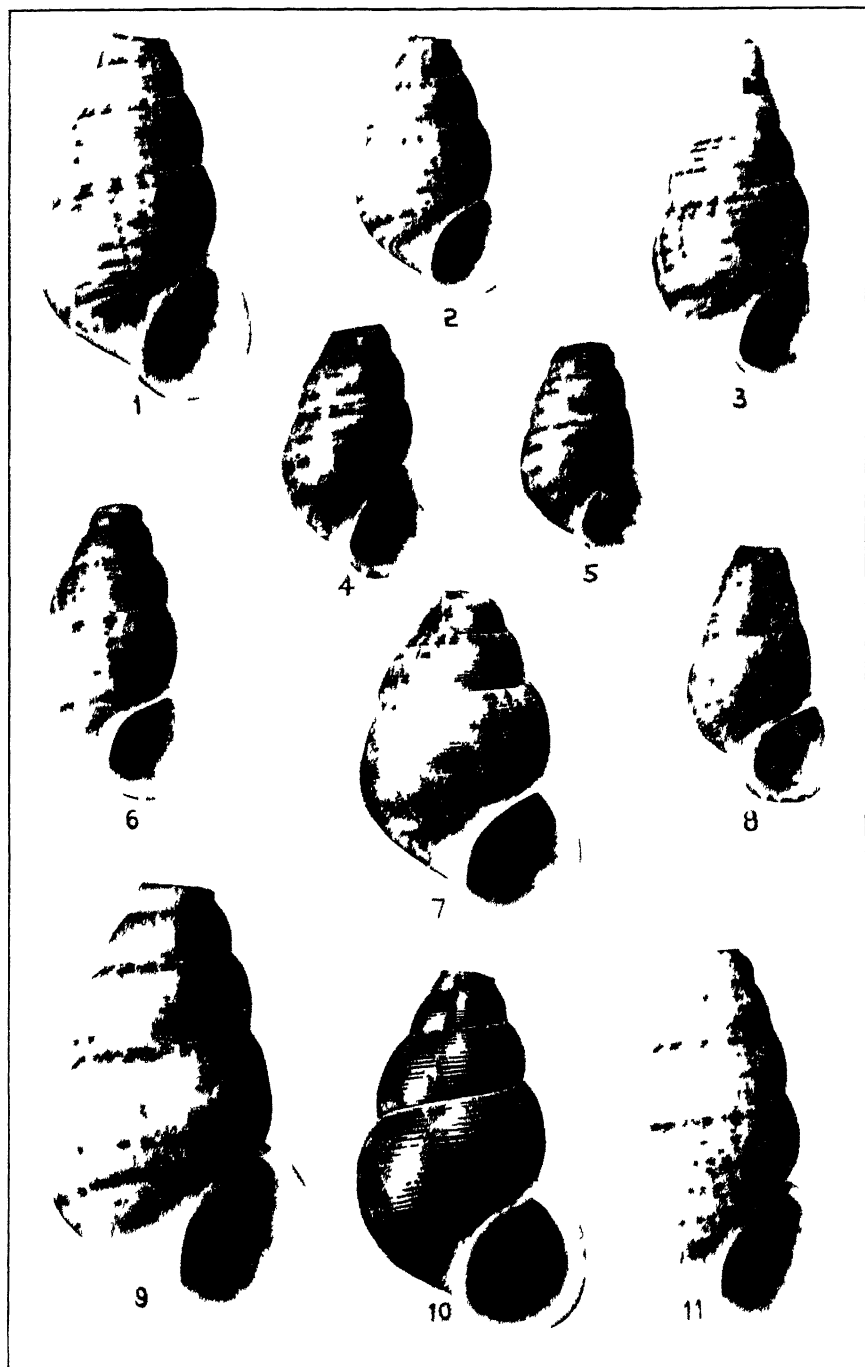
SPECIES AND SUBSPECIES OF CHONDROTHYRELLA (PLICATHYRELLA) (X4)

1 *tenebrosa subnello* 2 *claudicans ulmris* 3 *tenebrosa* 4 *claudicans* 5 *tenebrosa*



## SPECIES AND SUBSPECIES OF CHONDROTHYRIUM (X2)

1 *violaceum tigranense* 2 *v. lateranense* 3 *t. doloresi* 4 *t. morlet* 5 *t. rocai* 6 *t. saugeti* 7 *t. maqua en i* 8 *t. fomenten* 9 *t. tenue* 10 *t. ignotum* 11 *t. sopimpense* 12 *t. manatien* 13 *t. clerchi* 14 *t. serranum* 15 *t. alii* 16 *crenismargo* 17 *t. gonzalesi* 18 *t. banoense* 19 *t. violaceum* 20 *t. montanei*



## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) (X2)

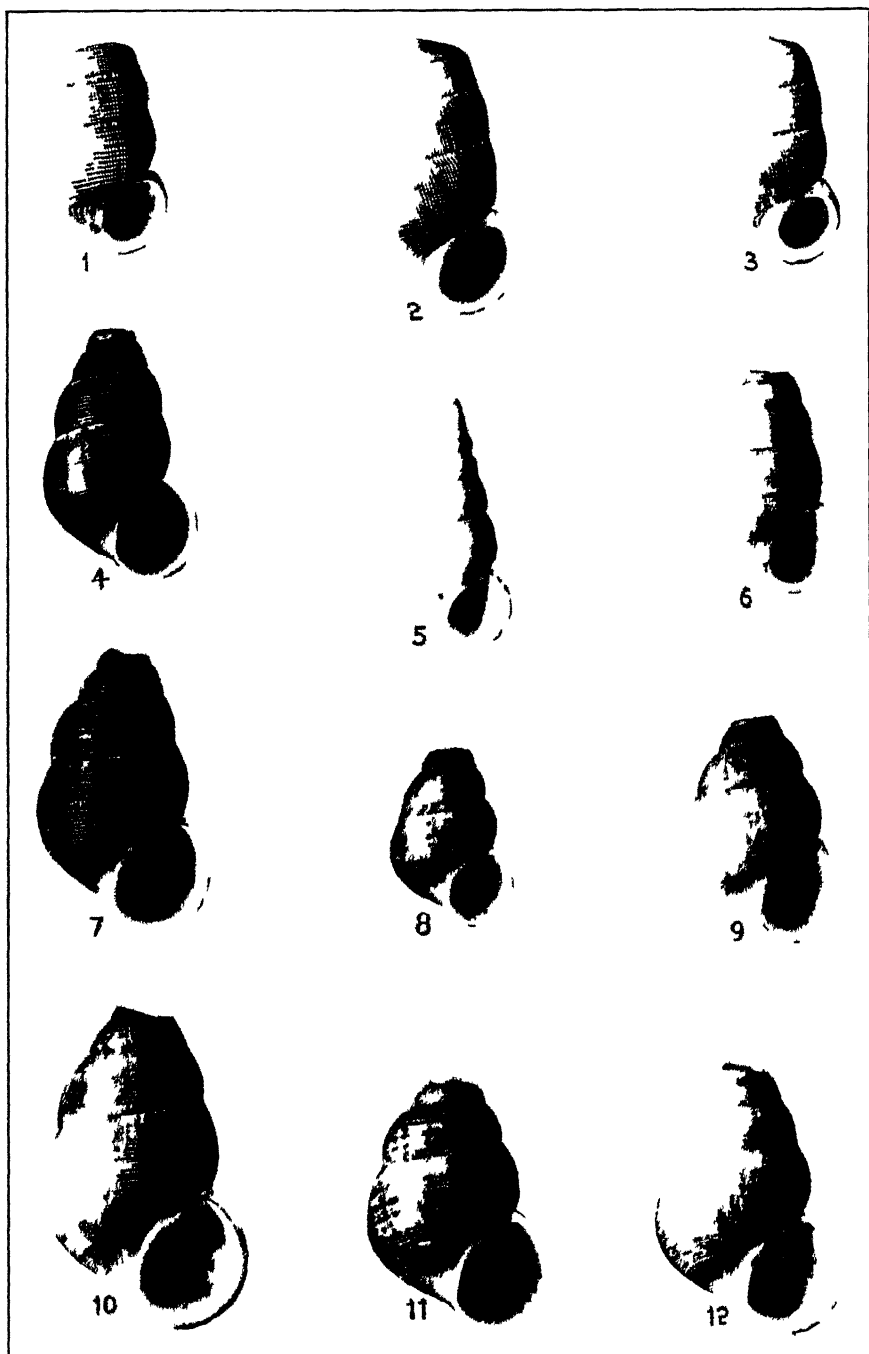
- 1 *pictum mahojani* 2 *p. pictum* *p. mochense* 4 *p. anafense* 5 *p. sajra* 6 *p. ymeriense* 7 *yucayum*  
*p. taraderense* 9 *p. celsum* 10 *p. goulcuanum* 11 *p. arangoi*





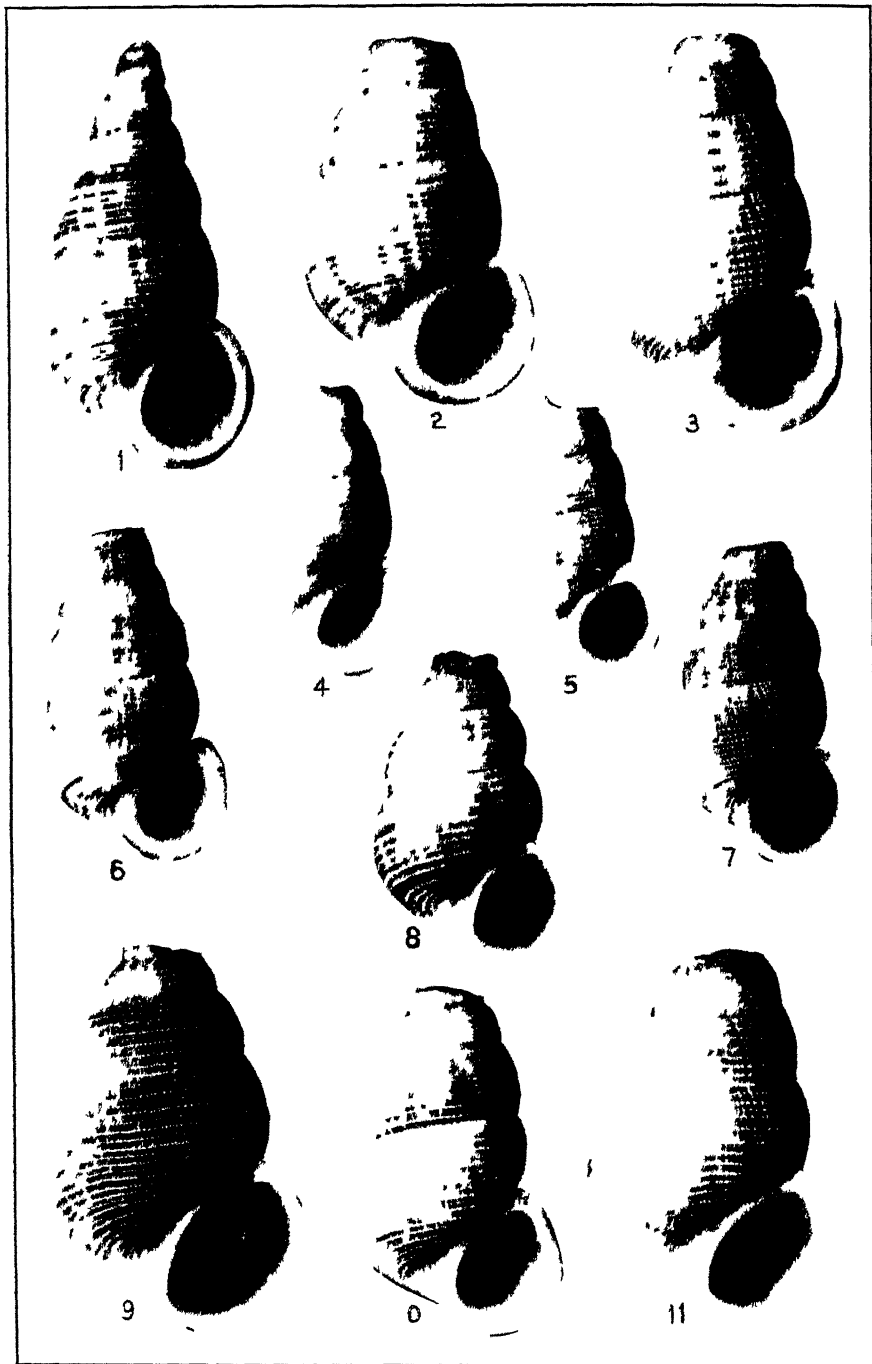
## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) (X2)

- 1 *plefferianum camoinse* 2 *pl plefferianum* 3 *pl ganu-raense* 4 *cognatum* 5 *poeyanum j bacoense* 6 *po preyanum* 7 *po occidentale* 8 *lembeyi* 9 *cabrerai* 10 *leoni* 11 *jaulense* 12 *perlatum* 13 *respertinum caballosense* 14 *respertinum* 15, 16 *co ombense* 16 *bibijaguense*



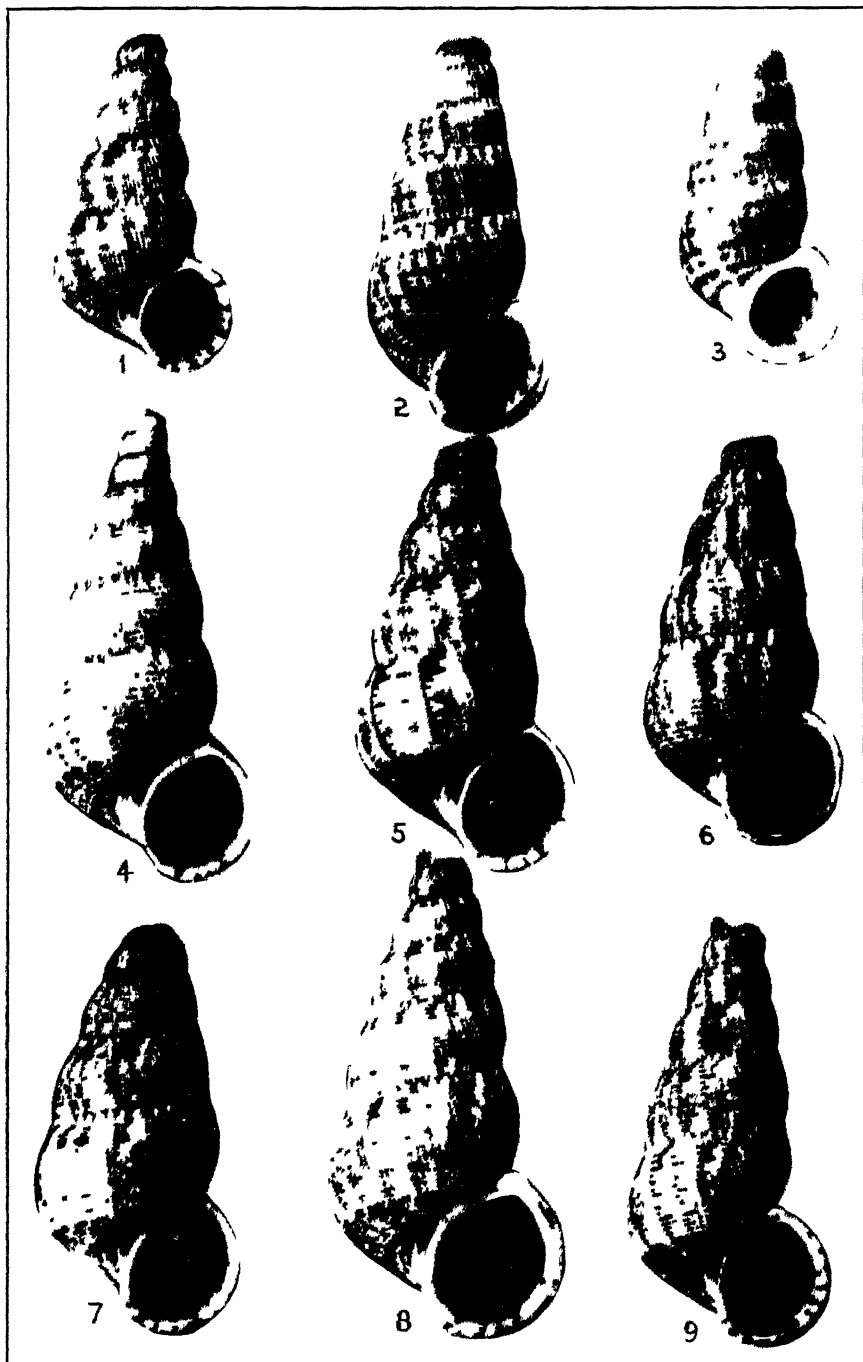
## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) (X2)

1 *marginalbum quantanense* 2 *m. marginallum* 3 *m. subquantanense* 4 *m. olivifrons* 5 *m. johanni*  
 6 *m. nicolasi* 7 *m. ulicori* 8 *moestum moralesi* 9 *garcianum* 10 *antonense* 11 *moestum decurrens* 12 *m.*  
*moestum*

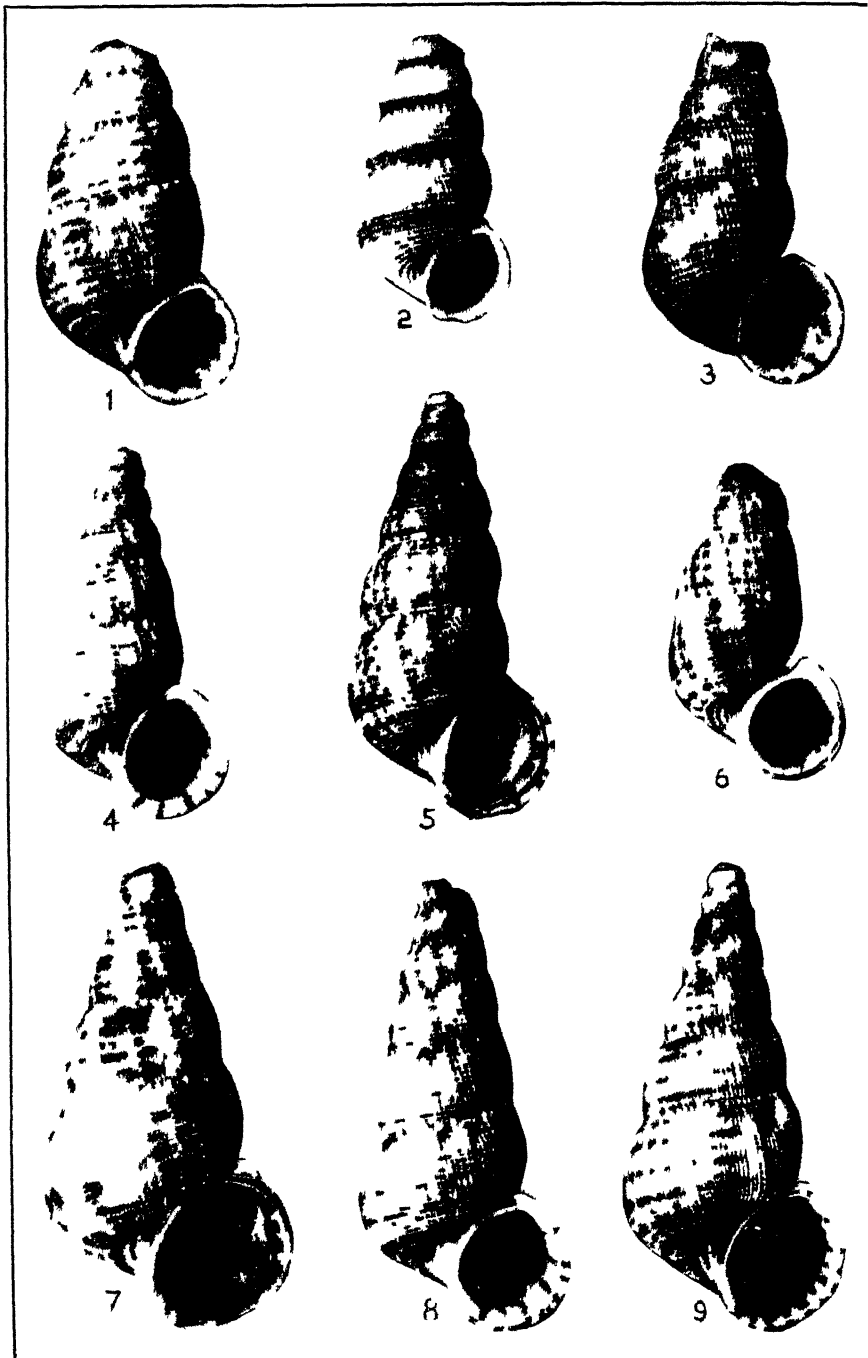


## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMA) (X2)

- 1 *carenasense carrioidesense* 2 *c. carenasense* 3 *c. toroense* 4 *ozytremum* 5 *c. guaraboense* 6 *c. rosariense*  
 7 *c. caritillense* 8 *obesum hersheyi* 9 *o. subobesum* 10 *o. palmasolense* 11 *o. obesum*

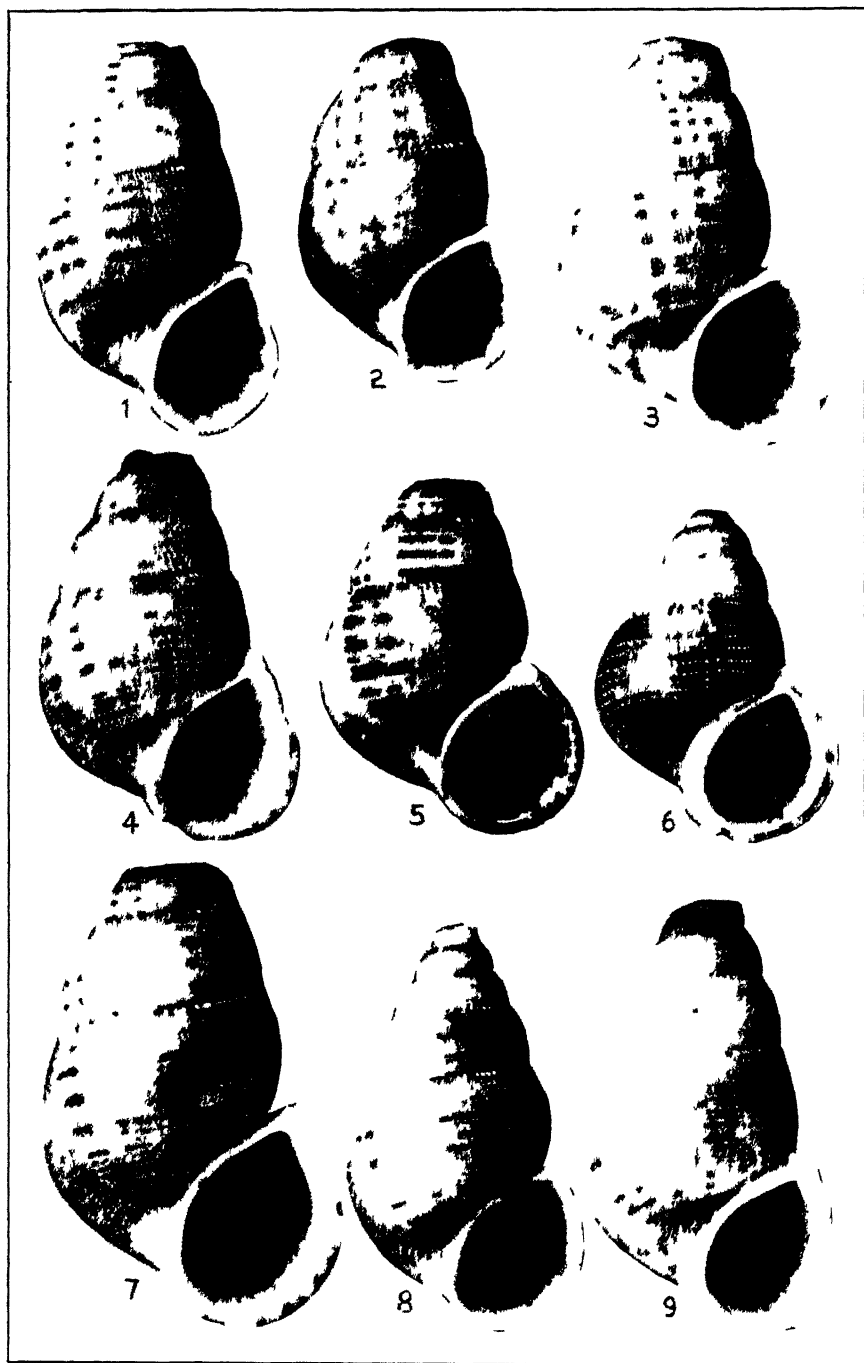
SPECIES AND SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMORUS*) (X4)

- 1 *delatzeanum bonacheum* 2 *d. santafeum* 3, *d. delatzeanum* 4 *reinctum reinctum* 5, *canescens alleni*  
 6 *r. biserranum* 7 *c. perplexum* 8, *c. canescens* 9, *c. nipense*



## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMORUS) (X4)

- 1 *auberianum auberianum* 2 *a. mayense* 3 *cisnerosi* (= *auberianum*) 4 *dilatatum pilotense* 5 *neglectum*  
 6 *d. layatense* 7 *d. toroense* 8 *d. subdilatatum* 9 *d. dilatatum*

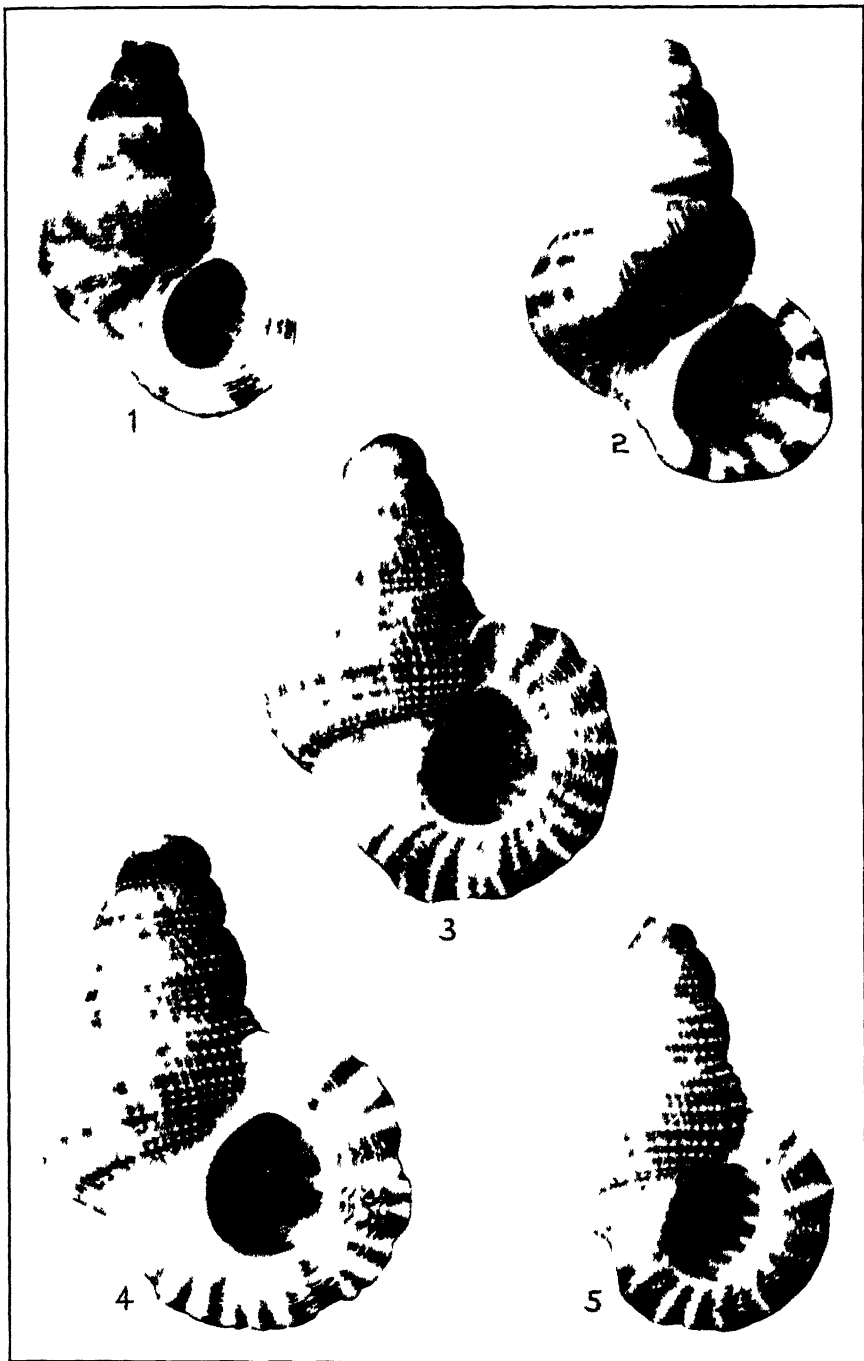


## SPECIES AND SUBSPECIES OF CHONDROPOMA (X4)

- 1 (*Chondropoma*) *edouardi* 2 (*C*) *laetum* 3 (*C*) *ed asperulum* 4 (*Chondropomodes*) *ernesti* 5 (*C*) *santalucense* 6 (*C*) *er clenchi* 7 (*Chondropoma*) *appendiculatum appendiculatum* 8 (*C*) *a sul*  
*appendiculatum* 9 (*Chondropoma*) *latissimum*



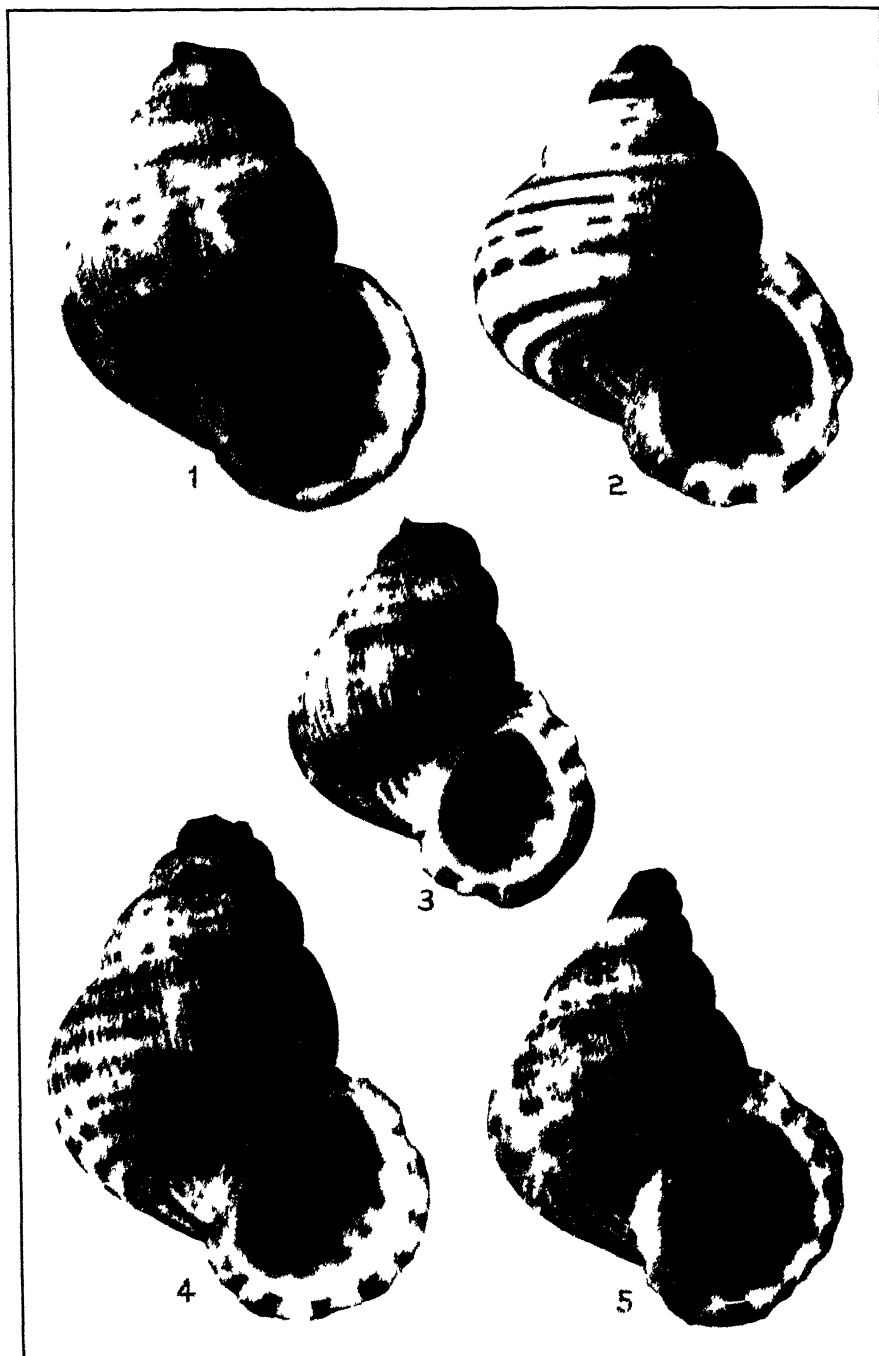
SUBSPECIES OF *CHONDROPOMA* (*CHONDROPOMARTES*) *IRRADIANS* (X4)  
*candicans* 2 *camaronense* 3 *figueroense* 4 *panense* 5 *palenquense*



## SPECIES AND SUBSPECIES OF CHONDROPOMA (X4)

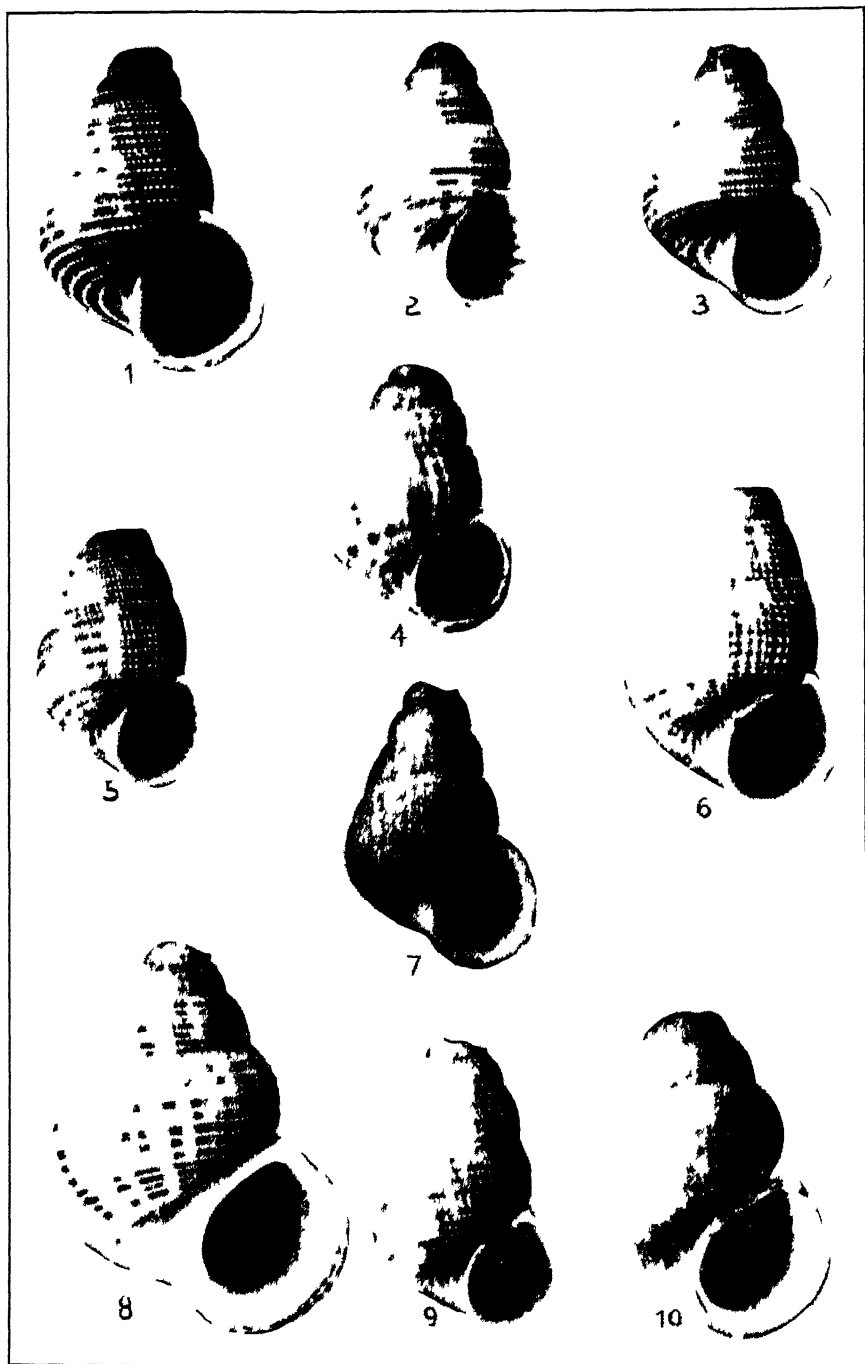
- 1 (*Chondropomartes*) *irradians irradians* 2 (*Gulicereium*) *montanum* 3 (*C*) *portuandoi* 4 (*C*) *presasianum*  
*presasianum* 5 (*C*) *p. canasense*





SPECIES AND SUBSPECIES OF CHONDROPOMA (GUTIERREZIUM) (X4)

1 *guisadense* 2 *bairdii* 3 *gutierrezii* 4 *negrosense* 5 *gutierrezii* 6 *canaliculatum*



## SPECIES AND SUBSPECIES OF CHONDROPOMA (CHONDROPOMISCA) (X4)

1 *unilabiatum rubrum* 2 *rufopictum* 3 *unilabiatum* 4 *undulatum* 5 *solidulum tananense* 6 *solidulum*  
 7 *oboleum* 8 *greenfieldi* 9 *solidulum* 10 *reincarnatum*





SMITHSONIAN INSTITUTION  
U. S. NATIONAL MUSEUM

Vol. 85

Washington: 1939

No. 3040

ON SOME SPECIES OF CHINESE EARTHWORMS, WITH  
SPECIAL REFERENCE TO SPECIMENS COLLECTED IN  
SZECHWAN BY DR. D. C. GRAHAM

By G. E. GATES

SINCE 1921 Dr. David C. Graham, of the West China Mission of the American Baptist Foreign Mission Society, has been collecting much natural-history material in the vicinity of his station at Suifu, Province of Szechwan, western China, as well as in the course of his travels through that Province. At the request of Dr. Waldo L. Schmitt, of the United States National Museum, I undertook the study of Dr. Graham's earthworms and began work in 1926. At that time little was known of the earthworms of China and nothing at all of the oligochaete fauna of the interior Province of Szechwan. Most of the known Chinese species had been characterized so inadequately that it was considered advisable to postpone publication until the types could be examined. Early in 1931, while I was on furlough from my duties at Judson College, Rangoon, the opportunity first came for me to study material in European museums, but currency fluctuations following American abandonment of the gold standard necessitated my abrupt departure from Europe before the work was completed. Before leaving, however, I studied the types or representative portions of type series of all species discussed herein except *Drawida japonica* (Michaelsen), *Pheretima hupeiensis* (Michaelsen), and *P. asiatica* (Michaelsen).

The original manuscript of this paper was completed in 1934, but as it was then impossible to publish it in full a preliminary report

on the new species was published (Gates, 1935). The paper is now brought to date to the end of 1936.

I wish to express my heartiest thanks to Dr. Waldo L. Schmitt for assistance on so many occasions as well as for the opportunity of examining Dr. Graham's material; to Dr. Max Thiel and Dr. Wilhelm Michaelsen, of the Hamburg Museum, and Dr. C. C. A. Monro, of the British Museum, for the courtesies of their institutions and for personal assistance given many times; to the Metropolitan Museum of China for forwarding specimens for examination; to Y. Chen for the opportunity of examining some of his specimens; and to the authorities of the Biological Institute of Harvard University and the Marine Biological Laboratory at Woods Hole, Mass., for accommodations provided while I was engaged in the final preparation of the manuscript.

### Family MONILIGASTRIDAE

#### Genus DESMOGASTER Rosa

##### DESMOGASTER SINENSIS Gates

1930. *Desmogaster sinensis* GATES, Ann. Mag. Nat. Hist., ser. 10, vol. 6, p. 590 (type locality: Soochow; type in author's collection).

1933. *Desmogaster sinensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 180.

*Material examined*.—From the U. S. National Museum: 3 acitellate specimens labeled "*Desmogaster sinensis* Gates; Soochow, China; identified by Y. Chen."

*Remarks*.—These specimens are much smaller than the type. No setae are visible on any of the worms. The spermathecal tubercles are more like anteroposteriorly flattened flaps than on the type.

The largest specimen was opened. The gizzards are three, in xiv-xvi. The nephridium of one side of xiii passes at its dorsal end into the ovisac, which otherwise is empty.

#### Genus DRAWIDA Michaelsen

##### DRAWIDA GISTI Michaelsen

1931. *Drawida gisti* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 1, 8 (type locality: Tsinan, Shantung; types in Hamburg and Peiping Museums); Zool. Jahrb. (Abt. Syst.), vol. 61, p. 525.

1935. *Drawida gisti* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 2.

*Material examined*.—From the Hamburg Museum: 2 clitellate specimens labeled "*D. gisti*."

*External characteristics*.—The setae begin on ii and are closely paired; *aa* slightly less than *bc*.

The nephridiopores of viii–xiii may or may not be displaced rather markedly dorsal to *d*.

The clitellar coloration (pinkish) extends across segments x–xiv and onto the posterior portion of ix.

The spermathecal pores are transverse slits on 7/8 just median to *c*, the anterior margin of the pore swollen so that the pore appears to be slightly behind 7/8. The female pores are minute, dark, grayish spots in slight, transverse, slitlike depressions on the anterior margin of xii, the slits in *ab*.

The apertures of the penial chambers are on 10/11 in *bc*, slightly nearer to *b* than to *c*. The true male pore is much smaller and at the ventral end of a penis, which may be completely withdrawn into the penial chamber (invisible from the exterior) or slightly protuberant through the chamber aperture.

On one specimen there is a pair of small presetal genital markings on x. Each of these markings is circular in outline, slightly elevated, about equal in width to interval *ab*, the median margin of the marking about in line *b*. The margin of the marking is opaque, the center of the marking of a grayish translucence. The clitellar coloration is lacking on a ventral region that includes the genital markings and extends across the anterior portion of x and the posterior portion of ix. On the second specimen a rather vague protuberance somewhat resembling the genital markings just described can be seen anteriorly on viii, in *ab*. The whitened ventral region is lacking on this worm.

*Internal anatomy.*—The gizzards are three, in xii–xiv (2 specimens). There are paired enterosegmental organs in several successive segments, beginning from xvi. There is a band of opaque whitish material on each side of the dorsal blood vessel. The last pair of hearts is in ix.

The testis sacs are kidney-shaped, the concave side directed ventrally; in ix and x, unconstricted by 9/10. The vas deferens is rather short and is twisted into two bunches of loops, the smaller on the anterior face of 9/10, the larger on the posterior face, the total mass of the two bunches of loops very much less than that of the testis sac above. The prostates are 6–7 mm in length. The middle portion is bent into a sort of C-shape and is placed around the penial chamber so that the open side of the C faces mesially. An ental portion is almost straight and pushes through 9/10 (at least in one specimen) into ix. An ectal portion of the prostate is bent under the posterior limb of the C and appears to pass into the lateral face of the penial chamber, close to the parietes. The granulations (external glandular layer) on the prostate extend to this apparent point of entrance into the penial chamber. Removal of a layer of connective tissue from the coelomic face of the chamber reveals a very slender, smooth, and glistening prostatic duct, which passes upward and into the chamber

about at the center of the dorsal face. Granulations (external glandular layer) are lacking on this duct portion, which is about one-half as long as the gland, the prostate and duct together being 9–11 mm long. The granulations can be scraped off from the prostate revealing a firm, rather slenderly tubular, glistening, central body, which decreases very gradually and only very slightly in width passing ectally. The penial chamber projects conspicuously into the coelomic cavity to a height of  $1\frac{1}{2}$ –2 mm, the dorsal surface smooth and regularly convex. The diameter is less than the height. The penis is  $1\text{--}1\frac{1}{2}$  mm long, slightly widened at the base (dorsally).

Laterally and dorsally septa 10/11 and 11/12 are attached to the parietes close together. In spite of the fact that both specimens were opened with considerable care, segment xi was opened by the dorsal incision in each worm. An ovarian chamber of the horse-shoe type is apparently lacking in this species. The ovarian segment is filled with loose ova (2 specimens). The ovisacs are not fully distended by ova and extend only into xiii and xiv or into xiv and xv.

The spermathecal ampulla is collapsed and contains only a small quantity of whitish material. The duct is twisted into a number of loops immediately under the ampulla and thence ectally is gradually widened. The duct passes, without definite external demarcation, into a rather digitiform atrium, which is in viii. In the wall of each spermathecal atrium (4 spermathecae) is a single, "urn-shaped" gland. The gland is almost spheroidal, pinkish, hard, rather large, the diameter of the gland greater than the thickness of the atrium.

Dorsal to each of the two genital markings of the first specimen is a parietal gland that projects into the coelomic cavity. No gland was found in the parietes of viii of the second specimen.

*Remarks.*—*Drawida gisti* is close to *D. hehoensis* Stephenson, 1924 (from Burma), from which it is distinguished as follows: Restriction of gizzards to segments xii–xiv; binding of a stalk portion of the prostate to the lateral face of the penial chamber by connective tissue; greater length of the penis; larger size of the spermathecal atria; incomplete closure of the ovarian segment; presence of an "urn-shaped" gland in the wall of each spermathecal atrium; presence of definite genital markings and their associated glands.

#### DRAWIDA GRAHAMI Gates

1935. *Drawida grahami* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 3 (type locality: Suifu, Szechwan; types in U. S. National Museum).  
1936. *Drawida grahami* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 291 (after examination of types).

*Material examined.*—From Dr. Graham: 6 acitellate or partially clitellate specimens and 1 clitellate specimen labeled "Suifu, Sept. 1924."

*External characteristics.*—Length, about 55 mm. Diameter, 4 mm.

The setae begin on ii and are closely paired; *aa* about equal to or slightly greater than *bc*.

The clitellar coloration (reddish) extends over segments x–xiii and onto the posterior portion of ix.

The spermathecal pores are tiny transverse slits or rounded pits on 7/8, halfway between *b* and *c*. The female pores were not identified.

The male pores, small apertures in *bc*, nearer to *b* than to *c*, are on slightly protuberant porophores, which are not, on some specimens, clearly delimited. In those specimens on which the preservation of these structures is the best, the male pore is at the ventral tip of the protuberance and in line with intersegmental furrow 10/11, the latter ending blindly on the lateral and median sides of the porophore. The anterior margin of the porophore may be indicated by a slight transverse groove, which does not pass into the intersegmental furrow. The posterior margin of the porophore is marked off by a short transverse furrow that passes laterally and mesially into 10/11.

The genital markings are transversely oval to circular, convex areas of grayish translucence; the margin sharply delimited by a slight circumferential furrow. The epidermis immediately around each marking may be specially whitened, but a definite rim such as characterizes the markings of *D. japonica* seems to be lacking. The markings are located on segments vii–xiii as follows:

1. Segment viii—middle annulus, both sides, in *bc*; ix—middle annulus, both sides, in *bc*; x—middle annulus, left side, in *bc*; xi—middle annulus, both sides, in *bc*.
2. Segment ix—presetal, both sides, about in line with the spermathecal pores; xi—middle annulus, both sides, in *bc*; xii—presetal pair in *aa*; xiii—presetal pair in *aa*.
3. Segment vii—presetal, both sides, in *bc* and a postsetal median; x—posterior annulus, both sides, in *bc*; viii—middle annulus, both sides, in *ab*; ix—posterior annulus, both sides, in *bc*; xi—middle annulus, both sides, in *bc*; xiii—presetal, median pair.
4. Segment viii—presetal, left side, in *bc*; ix—presetal, both sides in *bc*; xii—middle annulus, both sides, in *bc*; xiii—presetal, median pair.
5. Segment vii—anterior annulus, both sides, in *ab* and a posterior median; viii—anterior annulus, left side, in *bc*; ix—presetal and median; x—postsetal and median; xi—middle annulus, left side, in *bc* and one presetal median; xiii—one presetal median.
6. Segment vii—postsetal, left side, in *bc*, and one slightly to the right of the midventral line; viii—presetal, right side, in *bc*; ix—presetal, left side, in *bc*;



x—postsetal, both sides, in *ab*; xi—presetal pair in *aa*; xii—presetal, just to left of midventral line; xiii—presetal, both sides, in *aa*.

7. No genital markings.

*Internal anatomy.*—Septa 5/6-8/9 are thickly muscular; 9/10 thin and displaced posteriorly.

The last pair of hearts is in ix. There is a band of opaque material on each side of the dorsal blood vessel.

The gizzards are three in xii-xiv (8 specimens).

The testis sacs are usually flattened laterally and nearly fill the available space in segments ix and x. The vas deferens is short, rather thick relative to the size of the worm, and passes into the prostate mesially without first passing into the parietes. The prostates are flattened disks of circular outline, sessile on the parietes. The central body is tiny, ovoidal, the more pointed end within the parietes.

Segment xi is reduced to a closed-off ovarian chamber of horseshoe shape. The ovisacs are laterally flattened and confined to xii in the clitellate specimen. In other worms the ovisacs are slenderer and also confined to xii. A posteriorly elongated appendix such as characterizes *D. japonica* is lacking.

The spermathecal atrium is finger-shaped, erect on the posterior face of 7/8. The spermathecal duct (7-9 mm long) passes into the atrium near the ental end of the latter but runs ventrally in the atrial wall for a short distance before opening into the atrial lumen.

*Remarks.*—*D. grahami* is distinguished from *D. japonica* (Michaelson, 1892) as follows: Location of the spermathecal pores in mid *bc* rather than in or just median to *c*; direct entrance of the vas deferens into the prostate (rather than first passing into the parietes); prostates disk-shaped and sessile on the parietes (rather than erect or vertical and columnar to club-shaped); the very small, ovoidal, central body of the prostate with the pointed end buried in the parietes (rather than the elongate digitiform central body nearly 1 mm in length); absence of an elongate rodlike appendix on the ovisacs. One of the types is clitellate, hence fully mature, and presumably would have had ovisac appendages if these structures are normally present in this species. (In contrast, the rodlike appendices of the ovisacs are recognizable even in juvenile specimens of *japonica*.) The exact morphological location of the male pores was not determined, but the pores are in line with 10/11, though the latter is not recognizable across the male porophores. If the male pores are to be placed on 10/11 or the site of 10/11 this will be still another distinction from *japonica* in which the pores are quite definitely segmental, postsetal on x.

Chen (1936, p. 291) maintains that the types of *grahami* are identical with *japonica*. Chen's notes on *grahami* appear to be a confused composite of observations made on specimens of both *grahami* and

*japonica* (note that Chen gives the number of gizzards as two or three and compare with statements regarding number of gizzards in *grahami* *supra* and *japonica* *infra*; also compare Chen's comments on the ovisac appendages with the account given below). Chen failed to notice the characteristics of the prostates, which is indeed "unfortunate," as these organs are of first importance in systematic discrimination in the genus *Drawida*.

#### DRAWIDA JAPONICA (Michaelsen)

1892. *Moniligaaster japonicus* MICHAELSEN, Archiv für Naturg., vol. 58, p. 232 (type locality: Japan).  
 1927. *Drawida japonica* f. *typica* MICHAELSEN, Boll. Lab. Zool. Portici, vol. 21, p. 85 (Yunnan-fu).  
 1931. *Drawida japonicus* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 157 (part) (excluding f. *siemsseni*); Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 1, 7 (part) (excluding f. *siemsseni*); Zool. Jahrb. (Abt. Syst.), vol. 61, p. 523 (part) (excluding f. *siemsseni* and in the synonymy *D. willsi*).  
 1935. *Drawida japonica* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 3.

*Material examined*.—From the Hamburg Museum: 3 specimens labeled "V 1194. *Drawida japonicus* Mich. f. Typ. Dr. Chen F. Wu c. Dr. Michaelsen a. Nanking, China." From Dr. Graham: 2 clitellate specimens labeled "Suifu, Szechwan, 1929"; 2 clitellate specimens labeled "Near Yueh Shi, 6,000–8,000 feet, August 11, 1928"; 1 specimen with slight clitellar coloration labeled "Near Mupin, July 8, 1929"; 1 clitellate specimen labeled "Tatsienlu, 8,300 feet, July 16, 1930."

*External characteristics*.—The length varies from 39 to 65 mm, the maximum diameter from 1 to 2 mm.

The setae begin on segment ii and are closely paired; *aa* about equal to or slightly less than *bc*.

The clitellar coloration varies from pink to red and extends over segments x to xiii and onto the posterior portion of ix.

The spermathecal apertures are tiny circular pores or short transverse slits on 7/8, on or just median to *c*. The female apertures are minute, grayish spots, each pore at the bottom of a transversely slitlike depression on the anterior margin of xii close to 11/12, in *ab*.

The male pores are readily recognizable or scarcely visible and are located on segment x on the ventral faces of more or less protuberant porophores in *bc*, nearer to *b* than to *c*. Intersegmental furrow 10/11 passes behind the porophores and is slightly displaced posteriorly in a concave fashion just behind each porophore. The anterior margin of the porophore may be demarcated by a slight transverse furrow, which does not pass at either end into furrow 10/11, or the furrow may be lacking, the porophore represented only by a slight parietal protuberance on which the male pore is located. The median margin of the porophore is at *b* or very slightly lateral to *b*.

The genital markings have a circular or transversely oval outline and usually are slightly protuberant. Each marking usually comprises an opaque rim and a central, grayish-translucent, circular portion, but occasionally the rim appears to be lacking. The markings are located on segments vii-xiii on the new specimens as follows:

1. Segment viii—anterior annulus, left side, just lateral to the spermathecal pore; ix—posterior annulus, left side, in *bc* but nearer to *b* than to *c*; x—posterior annulus, right side, just lateral to lateral margin of the male porophore.

2. Segment vii—posterior annulus, right side, lateral to spermathecal pore; viii—anterior annulus, each side, just lateral to the spermathecal pore; ix—middle annulus, right side, in *bc*.

3. Segment viii—presetal, right side, in *bc* just behind the spermathecal pore; ix—presetal, right side, in *bc*; x—presetal, left side, in *bc*; xi—presetal, right side, in *bc*.

4. Segment viii—presetal, left side, in *bc* slightly median to the spermathecal pore; ix—presetal, left side, in *bc*; x—presetal, right side, in *bc*; xi—presetal, left side, in *aa*; xii—presetal, left side, in *aa*; xiii—postsetal, median.

5. Segment viii—postsetal, right side, in *ab*; ix—presetal, left side, in *ab*.

6. Segment ix—presetal, right side, in *bc*; x—presetal, left side, in *bc*.

*Internal anatomy.*—Septa 5/6-8/9 are thickly muscular; 9/10 thin and displaced posteriorly. The last pair of hearts is in ix. There is a band of opaque material on each side of the dorsal blood vessel.

The gizzards are two, in xii-xiii (2 specimens) or three, in xii-xiv (4 specimens).

The testis sacs are ovoidal or kidney-shaped, in the latter case the concave side directed ventrally; in ix and x, uncontracted by 9/10. The vas deferens is short, rather thick, relative to size of the worm, in 9/10 with several loose loops into ix and x. The vas passes posteriorly on the parietes in segment x and into the body wall at a point slightly median to the entrance of the prostate into the parietes. The prostates are shortly club-shaped and erect; the entalmost portion may be two to three times as thick as the more ectal coelomic portion. Removal of the external glandular layer reveals a whitish, slenderly tubular, central body. In none of the specimens examined is there any widening of the ental end of the central body to correspond to the ental thickening of the external glandular layer.

Segment xi is reduced to a closed-off ovarian chamber of horseshoe-shape. The laterally flattened ovisacs appear to terminate, at first glance, in the region of segments xiv-xvii. If, however, the gut is carefully rolled over to one side a long slender rodlike body can be seen in the vicinity of the nerve cord on each side. This can be traced anteriorly into the region of segments xvii-xiv, where it passes dorsally at the side of the esophagus and gradually or abruptly merges into the wide portion of the ovisac. Thus, in reality, the ovisacs extend posteriorly into xxvi-xliii, xxvi (1 specimen), xxxvii and xli (1 specimen). In one worm the rodlike appendix of one side passes

over the gut but under the dorsal blood vessel and down onto the ventral parietes on the other side. In another specimen the appendices terminate in **xx**, but segments **xxi-xxxvii** are filled with ova while to the left of the nerve cord in **xxvii-xxxvi** and to the right in **xxxvii-xliii** is a posterior continuation of the appendix. Presumably the appendices were ruptured sometime previous to collection, releasing numbers of ova, after which the broken ends closed over.

The spermathecal duct is rather thick relative to the size of the animal and is 3-4 mm long. The atrium is finger-shaped, erect, on the posterior face of  $7/8$ ,  $1\frac{1}{2}$ - $3/4$  mm high, length greater than thickness. The spermathecal duct passes into the atrium near the ental end but runs ventrally in the wall of the atrium nearly to the parietes before its lumen opens into the atrial lumen.

Convex, rounded glands project conspicuously into the coelomic cavities dorsal to the genital markings.

*Remarks.*—*D. japonica* was erected on two specimens from Japan, which are no longer available for study, as they were sectioned. In these circumstances it has been necessary to determine certain important specific characteristics from later specimens identified by the author of the species. There is at present little if any evidence against the correctness of the identification, though earlier accounts of the species leave much to be desired. Although Stephenson speaks of the prostates as "opening on the surface in groove 10/11" in his Indian specimens (1922, p. 126), he definitely figures a segmental location of the male pores (1923, p. 142). The ovisac appendages were not mentioned by previous authors, and hence it is of interest that Stephenson clearly shows a section through an appendix resting on the parietal floor of segment **xii** (1922, pl. 1, fig. 4, labeled sac).

Chen (1936, p. 291) maintains that the presence of the ovisac appendages and the location of the spermathecal pores are not of sufficient value to distinguish *japonica* from *grahami*. Even if Chen be correct with regard to these two points, other differences enumerated above (*vide* remarks under *D. grahamsi*) are important enough to justify the specific distinction of the two forms.

Just recently 6 acitellate and juvenile specimens from Murree in the northwestern Himalayas have been examined. Although there are no free ova in segment **xi** and the ovisacs are obviously juvenile, two rodlike appendices are present in each of these specimens. The portion of the ovisac corresponding to that usually present in species of *Drawida* is as yet scarcely differentiated. The appendices extend into **xxv** in one specimen, into **xviii** in another, and in each specimen pass ventrally to the parietes near the nerve cord either on their own sides or after crossing to the opposite side under the dorsal blood vessel.

## DRAWIDA SIEMSSeni Michaelsen

1910. *Drawida japonicus* f. *siemsseni* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 27, p. 50 (type locality: Foochow; type in the Hamburg Museum).
1931. *Drawida japonicus* f. *siemsseni* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 157; Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 1, 7; Zool. Jahrb. (Abt. Syst.), vol. 61, p. 525.

*Material examined*.—From the Hamburg Museum: 1 specimen labeled "V 6333. *Drawida japonicus* Mich. f. *siemsseni*. Tiensin, Futschau."

*External characteristics*.—The genital markings and the male porophores are different from those of *D. japonica*. The clitellar glandularity appears to be only partially developed.

*Remarks*.—Forma *siemsseni* was erected on a single specimen that was distinguished from f. *typica* by the greater length, greater thickness, greater number of segments (said to be "sehr ungenau") and "ungefähr" 6 gizzards. The internal organs were removed in course of the original dissection and have been lost.

The "type" of f. *siemsseni* quite clearly is specifically distinct from *D. japonica*, but the species cannot be adequately characterized in the absence of the internal organs.

## Genus PHERETIMA Kinberg

Within the genus *Pheretima* the prostomium, secondary annulation, gizzard, ovaries, oviducal funnels, and female pores do not provide characteristics that are of taxonomic importance. Reference to these has accordingly been omitted in succeeding pages. In each of the species described hereinafter, in absence of definite indication to the contrary, a gizzard is present in segment viii or in a region between septum 7/8 and either 9/10 or 10/11, while ovaries and oviducal funnels are present in segment xiii with a single female pore on xiv. As a rule, reference to color or pigmentation has been omitted, since many of the specimens have been bleached.

No reference has been made in the specific descriptions to the paired tufts of enteronephric pharyngeal nephridia at the sides of the gut in segments iv–vi. These nephridia apparently are always present and have been noted definitely in all the Chinese species examined except *P. choeina*. Absence of mention, in the laboratory notes, of these nephridia is probably merely an oversight. "Blood glands" in v or v and vi have been noted in the following species only: *P. antefixa*, *californica*, *forficata*, *pectenifera*, *pingi*, *schmardae*, *szechuanensis*, *tuberculata*, and *vulgaris*. "Lymph glands" are probably present much more frequently than the occasional references in the specific descriptions indicate.

Intestinal caeca characterized by a single longitudinal axis are termed simple regardless of the depth of incisions on the dorsal and (or) ventral margins of the primary caecal evagination. Intestinal caeca with several longitudinal axes and with a rather characteristic glove-shaped conformation are termed compound.

#### PHERETIMA ABDITA Gates

1935. *Pheretima abdita* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 5 (type locality: Suifu, Szchewan; types in U. S. National Museum).

1936. *Pheretima abdita* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 292 (after examination of types).

*Material examined*.—From Dr. Graham: 1 partially clitellate specimen labeled "Suifu"; 1 partially clitellate specimen labeled "Suifu, 1,000 feet, July 1925"; 14 clitellate specimens labeled "Chungking, 2,000 feet, May 6-27, 1930."

*External characteristics*.—Length, 80-140 mm. Maximum diameter,  $3\frac{1}{2}$ -6 mm.

The setae begin on ii, on which segment there is a complete circle. The setae are small and regularly spaced, a trifle more widely separated dorsally than ventrally. There is no midventral break in the setal circles, a middorsal break when present of variable width. The setal numbers are as follows:

vi	vii	xvii	xviii	xix	xx	First dorsal pore
42	44	16	16	19	54	12/13
30	30	16	14	16	55	12/13
39	41	( <sup>1</sup> )	* 4	( <sup>1</sup> )	-----	12/13
39	41	16	16	18	61	12/13
41	43	16	13	16	56	12/13
39	39	16	15	16	56	11/12
38	39	15	17	17	69	12/13
38	36	14	15	16	58	12/13

<sup>1</sup> Wide gaps in setal circles, no pits visible in the gaps.

\* Gaps with empty setal pits in the setal row.

The first dorsal pore is usually on 12/13.

The clitellum is annular, extending from 13/14 to 16/17 or not quite reaching to one or both of those limits; dorsal pores and intersegmental furrows lacking; setae present, at least ventrally, on all three segments.

The spermathecal pores are rather small, with puckered margins, widely separated, three pairs on 5/6-7/8.

The apertures of the male parietal invaginations on xviii are usually elongate-slitlike but may be somewhat rounded. The invaginations

are deep but confined to the parietes. The lateral wall of the invagination is thin, the ventral margin of the lateral wall liplike. On the median wall of the invagination is a large, circular, smooth, glistening area. The central portion of this area may be depressed into a vertical slit or groove. In the lateralmost or dorsalmost portion of this groove or slit the tip of the penis can usually be seen. The slit opens into a small, rounded, muscular bulb into which the penis is retracted, partially or completely. The smooth area on the median wall of the invagination may be raised in such a way as to have the appearance of a thickish ring around the base of the penis.

The everted parietal invagination has the appearance of a spheroidal knob. On the ventral face of this knob, in incomplete eversion, is a pitlike depression from which the tip of the penis protrudes. In complete eversion the entire length of the penis is visible. The penis is slenderly tubular, the tip rather pointed, the base slightly thicker; about 1 mm or slightly more in length.

The genital markings are presetal, paired, on xviii and xix. Each marking is transversely but shortly elliptical, about 5-9 intersetal intervals wide transversely, with a large, grayish, translucent, concave-depressed center and an opaque whitish rim. The lateral margins of the markings are just median to the apertures of the parietal invaginations, the median margins of a pair separated by a midventral space equal to 5-6 intersetal intervals. Anteroposteriorly the markings extend from just in front of the setae to the intersegmental furrow. The latter is slightly displaced toward the anterior end by the genital markings on all specimens on which the furrow is visible.

On each side of the body and extending from the margin of the clitellum posteriorly for several segments is a rather high ridge. The midventral region between these two ridges has a longitudinally rectangular appearance. The apertures of the male parietal invaginations are on the ventral faces of the longitudinal ridges, the genital markings on the median faces.

*Internal anatomy.*—Septa 5/6-9/10 are thickly muscular; septa 10/11-12/13 also muscular, especially 10/11, but not so thick as the anterior septa.

The esophagus in segments xiii or xiv-xv is strongly distended by soil, the esophageal wall very thin, sometimes actually transparent. The origin of the intestine is not quite clear but appears to be in xvi. The intestinal caeca are simple, long, slender, with smooth margins.

The paired hearts of ix-xiii all pass into the ventral trunk. In two specimens a pair of large heartlike commissures in ix connects

the supraesophageal and the ventrolateral vessels. These extra commissures are filled with blood and more readily visible than the empty commissures of ix connecting the dorsal and ventral trunks.

The single testis sac of x includes, in addition to the male funnels, testes and testicular material, the segmental portions of the esophagus, and the dorsal blood vessel, as well as the hearts of x. The sheet of tissue forming the boundary of the sac is attached anteriorly to 9/10 close to the esophagus at least dorsally and laterally. The wall of the sac is bulged out laterally on each side to a considerable extent by the testicular material. When the worm is first opened these lateral bulges look like a pair of fairly well developed seminal vesicles. The single testis sac of xi is either U-shaped or annular and is attached to 10/11 only close to the esophagus. The two dorsal limbs of a U-shaped sac may be symmetrical, the dorsal blood vessel between the ends of the limbs or one limb may be longer than the other, in which case the segmental portion of the dorsal blood vessel is within the longer limb. The annular testis sac is formed, presumably, by the fusion of the dorsal ends of the limbs of a U-shaped sac.

The seminal vesicles of xi are within the testis sac of the segment and are rather small. In some cases a small but definite, columnar, primary ampulla can be recognized. The vesicles of xii are larger than those of xi and usually asymmetrical. The larger vesicle, that of the left side, may extend posteriorly into contact with the prostate. The right vesicle may extend over onto the left side of xii as well as penetrating into xiii, or it may be confined to xii.

The prostates are broken up into a number of elongate finger-like lobes, and these lobes are not as a rule compacted into a solid mass. The prostatic duct is 5-6 mm in length, the middle portion thickest and bent into a C-shape. Just ectal and just ental to the C-portion there may be a tiny quirk or loop. Within the parietes the prostatic duct is widened to form a small bulbous body.

The spermathecae are small. The spermathecal duct is nearly as long as, or slightly longer than, the ampulla and is narrowed only very slightly within the parietes. The diverticulum is longer than the combined lengths of duct and ampulla and passes into the median face of the duct just below the ampulla. A very short ectal portion of the diverticulum is slenderly tubular, smooth, and glistening; the remaining portion of the diverticulum widened slightly, bent back and forth in a regularly but shortly zigzagged fashion, the successive limbs of the loops in contact and all in the same plane.



Within the parietes and sometimes projecting slightly into the coelomic cavity are glandular masses, one mass dorsal to each of the genital markings.

*Remarks.*—On the two partially clitellate Suifu specimens the spermathecal pores of 5/6 and 6/7 are nearer to the midventral line than are the pores of 7/8. The spermathecal setae of these two specimens are: vi/27–26, vii/26–26. In all other respects the Suifu worms are like those from Chungking.

*P. abdita* is close to *P. indica* and *P. gemella* but is distinguished from both by the restriction of the male invaginations to the parietes, by the muscularity of septa 8/9–9/10, by the genital markings on xviii and xix, and by the three pairs of spermathecae.

#### PHERETIMA ANTEFIXA Gates

1935. *Pheretima antefixa* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 6 (type locality: Suifu, Szechwan; types in U. S. National Museum).  
 1936. *Pheretima antefixa* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 293 (after examination of types).

*Material examined.*—From Dr. Graham: 2 clitellate specimens labeled "Suifu, Szechwan, May 25, 1930"; 1 clitellate specimen labeled "Suifu, 1,000–1,300 feet, May 1–30, 1930"; 4 clitellate specimens labeled "Suifu, 1,000–1,400 feet, April 25–28, 1950"; 2 clitellate specimens labeled "south of Suifu, 1,000–1,500 feet, March 25, 1929."

*External characteristics.*—Length, 85–120 mm. Diameter,  $3\frac{1}{2}$ –5 mm.

The setae begin on ii, on which segment there is a complete circle. The ventral setae of ii–ix are enlarged and widely spaced, occasionally the setae of viii–ix less enlarged than those of the anterior segments; the setae of x and succeeding segments definitely smaller and more closely spaced. Setae may be present ventrally on all clitellar segments or only on xvi, in the latter case the number varies from 7–16. The setal numbers are as follows:

viii	xvii	xviii	xix	xx	First dorsal pore
12	15	8	15	41	(?) 13/14
12	14	7	15	39	12/13
13	13	9	12	38	12/13
12	15	7	15	-----	(?)
14	16	9	17	-----	12/13
12	12	6	13	42	12/13
12	17	8	17	36	12/13
12	18	10	17	36	12/13
12	12	10	17	40	12/13

<sup>1</sup> No functional pores anterior to the clitellum (?).

The clitellum is annular, extending from 13/14 to 16/17, intersegmental furrows and dorsal pores lacking on eight specimens, functional dorsal pores present on one specimen.

The spermathecal pores are minute, widely separated, one pair, on 8/9.

In the setal circle of xviii on each side is a short transverse ridge, toward the lateral margin of which the minute male pore is located. Rarely the portion containing the male pore is definitely separated from the rest of the ridge as a distinct tubercle. On one specimen the ridge is represented only by a lateral male pore tubercle and a transversely oval tubercle at the approximate site of the median end of the ridge.

Each worm is characterized by the presence of a median, presetal genital marking at the midventral line on segments iii, iv, and v. The markings are circular, the diameter about equal to interval *aa*; the grayish, translucent, central area within the narrow, opaque, whitish rim is flat, convex, or concave.

*Internal anatomy.*—Septa 5/6–7/8 are thickly muscular; 8/9–9/10 lacking; 10/11–13/14 strengthened, 10/11–12/13 more than 13/14 but none of these so thick as the pregizzard septa.

The intestine begins in xv. The intestinal caeca are simple; the ventral margin is incised, the depths of the incisions decreasing anteriorly; the secondary lobes, short and rounded or longer and rather finger-shaped, are always directed ventrally. The dorsal margin may be slightly incised.

The single heart of ix may be on either the right or the left side. The hearts of x were not found in some specimens but were located in one worm on the anterior face of 10/11, where they were covered by connective tissue. The last pair of hearts is in xiii. The hearts of ix–xiii all pass into the ventral trunk.

There is a single ventral testis sac with a bilobed anterior margin projecting conspicuously from the anterior face of 10/11. There is also a single ventral testis sac in xi, but the anterior margin is so deeply indented that there appear to be two separate conical sacs with the bases of the cones on the anterior face of 11/12 while the pointed anterior ends are directed toward 10/11. The anterior points of the testis sac do not reach 10/11, but a tiny thread passes from the apex to 10/11. The buttonlike testes are in the apices of the sacs and not on the posterior face of 10/11. The seminal vesicles of xi and xii are in contact transversely over the dorsal blood vessel. Each vesicle may have a primary ampulla, definitely characterized as to color and surface appearance, and may be almost completely constricted off from the ventral lamina or deeply sunk into the dorsal

margin of the latter. The prostates extend through xvii-xxii. The prostatic duct is 3-5 mm long, straight or bent into a C-shape, with a tiny quirk just before passing into the parietes.

The spermathecal duct is much shorter than the ampulla and narrowed gradually in the parietes. The diverticulum, which is about equal to the combined lengths of the duct and ampulla or a trifle shorter, passes into the duct in or close to the parietes and comprises an ectal, slender, smooth-surfaced, firm stalk with a very narrow lumen and a more irregular, thinner-walled seminal chamber with a wider lumen. The elongate tubular seminal chamber may be twisted, almost straight, or with one or two very slight loops; it may be of about the same caliber throughout or the entalmost portion may be slightly widened.

Numbers of stalked glandular masses protrude into the coelomic cavity dorsal to each of the genital markings, the ducts passing into the parietes under the nerve cord. In some of the specimens what appears to be glandular material was found in the parietes around the spermathecal duct. No glandular material was found in the parietes in the region of the prostatic duct in the specimens that were carefully dissected.

*Remarks.*—Two worms were found on dissection to have a small spermatheca each in segment vii, with the duct passing into the parietes in the region of 7/8, though no spermathecal pore had been noted during the external examination. One of these spermathecae lacks a diverticulum. The other spermatheca has a diverticulum but with no spermatozoal iridescence, though seminal chambers of normal spermathecae from the same worm do have the iridescence.

*P. antefixa* is distinguished from all other bithecal species of *Pheretima* with spermathecal pores on 8/9 by the unpaired, presetal, median genital markings and their anterior location.

PHERETIMA ASPERGILLUM (E. Perrier)

1872. *Perichaeta aspergillum* E. PERRIER, Nouv. Arch. Mus. Hist. Nat. Paris, vol. 8, p. 118 (type locality unknown; type in the Paris Museum).  
1891. *Perichaeta aspergillum* ROSA, Ann. Nat. Hofmus. Wien, vol. 6, p. 403 (Amoy).  
1899. *Amyntas aspergillum* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 16, p. 10 (Kowloon, near Hongkong).  
1905. *Pheretima lauta* UDE, Zeitschr. wiss. Zool., vol. 83, p. 464 (type locality: Foochow; type in the Hamburg Museum).  
1910. *Pheretima aspergillum* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 27, p. 102 (Foochow and Hongkong).  
1929. *Pheretima paraglandularis* FANG, Sinensia, vol. 1, p. 15 (type locality: Chiu-chang, Ling-yung-shien, northwestern Kwangsi; types in Metropolitan Museum of Natural History, Nanking).  
1930. *Pheretima aspergillum* LIN, Peking Nat. Hist. Bull., vol. 5, p. 15.

1931. *Pheretima aspergillum* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 158 (excluding Formosa from the distribution ?).
1931. *Pheretima* (*Ph.*) *siemsseni* (part) + *P. lauta* + *P. aspergillum* + *P. paraglandularis* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 2, 3, 17 (type locality of *siemsseni*: Foochow, Fukien; type in the Hamburg Museum).
1931. *Pheretima siemsseni* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 61, p. 571 (part).
1931. *Pheretima paraglandularis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 159 (examination of type).
1932. *Pheretima lauta* GATES, Lingnan Sci. Journ., vol. 11, p. 513.
1935. *Pheretima aspergillum* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 7.

*Material examined*.—From the Hamburg Museum: 3 specimens (A) labeled "*Pheretima aspergillum* E. Perr. China. Futschau"; 1 specimen (B) from a tube<sup>1</sup> labeled "*Pheretima* (*Ph.*) *siemsseni* Mich. Originale, China, Futschau. Consul Siemssen leg."; and 1 specimen (C) labeled "V 10472, *Pheretima lauta* Ude. China, Futschau. Consul Siemssen." From the U. S. National Museum: 7 macerated clitellate specimens labeled "Foochow, China. C. R. Kellogg, collector."

*External characteristics*.—The setae begin on ii, on which segment there is a complete circle. The setae are small and regularly spaced; no definite midventral break in the setal circles; a middorsal break, when present, variable in width. The setal numbers are as follows:

viii	xvii	aviii	xix	xx	Specimen
27	34	13	35	88	A
29	33	18	38	97	
27	32	<sup>1</sup> 7	34	84	
27	31	16	30	<sup>2</sup> 70	B
31	33	14	32	-----	C

<sup>1</sup> Gaps in the setal row.

<sup>2</sup> Gaps in setal circle in which setae may have been present.

The first dorsal pore is on 11/12 (4 specimens—A and B).

The clitellar glandularity is only slightly developed on the three specimens of A; the clitellar coloration dark reddish, extending from 13/14–16/17; intersegmental furrows and dorsal pores present; setae visible at least ventrally. The clitellum of specimen C is also probably not fully developed. The clitellum of specimen B appears to be more completely developed, but there are slight traces of the intersegmental furrows ventrally and also ventral setal pits in which no setae can be seen.

<sup>1</sup> In addition, this tube contains a specimen of *P. robusta* and an acitellate, softened, and unidentifiable specimen of *Pheretima* sp.

The spermathecal pores are minute, widely separated, on tiny protuberances; two pairs, on 7/8-8/9.

At the center of each male pore area on xviii of specimens A is a narrow transverse ridge, roughened or finely lobulated. On the lateralmost portion of this ridge is a tiny papilla on which is the minute male pore. No setae are visible on the ridge, which is in line with the setal circle. Just anterior and just posterior to each of these male pore ridges are two transverse rows of tiny, very short, columnar tubercles or papillae; the ventral face of each column is flattish or slightly depressed, the central area grayish, translucent, and surrounded by a narrow, opaque, whitish rim. The number of the papillae in each male pore region varies from 15 to 17. The body wall immediately in front of and just behind the male pore ridge together with the tubercles thereon is slightly depressed. The whole of the region just described is surrounded by 4-6 concentric furrows; each furrow outlines a transversely oval area with the more pointed portion mesially. The furrows reach beyond the limits of xviii, slightly invading segments xvii and xix.

On specimen B the male pore ridges are not clearly visible; there are only 10-13 markings, none of which have a columnar appearance; the concentric furrows outline longitudinally oval areas.

On specimen C the male pore ridges are also not clearly visible, but the concentric furrows are like those on specimens A. The genital markings are closely crowded and, as a result of maceration, are difficult to count; about 17 markings on each area.

On Kellogg's specimens, the number of markings on a male area varies from 10 to 23, the transverse ridges visible. The male pore tubercles are slightly lateral to, and usually a trifle larger than, the genital markings.

The preclitellar genital markings (A) are very similar to those of the male pore region but do not have a columnar appearance and are located slightly median to the spermathecal pores, in transverse rows of 2-5, one row each on the anteriormost margins of viii and ix and the posteriormost margins of vii and viii. The genital markings may be entirely lacking in the vicinity of a particular spermathecal pore. On specimen B the preclitellar genital markings are (probably) almost entirely lacking. There is, however, a single very definitely outlined marking on the posteriormost margin of vii on the right side just median to the spermathecal pore of 7/8. On specimen C the genital markings are quite characteristic, each row with 5-7 markings. On Kellogg's specimens the number of markings in a row varies from 0 to 8.

*Internal anatomy.*—(The internal organs had been removed from the anterior end of specimen B. Specimen C had been dissected, the

internal organs in part disarranged and softened. Five of Kellogg's specimens had also been opened.)

Septa 5/6-7/8 are thickly muscular, as are 10/11-13/14; 8/9-9/10, lacking.

There is a small but very distinct glandular collar (smooth, without lobulations) on the esophagus just behind the gizzard (3 specimens). The intestine begins in xv (3 specimens). The intestinal caeca are simple, more or less finger-shaped, and directed anteriorly. Both dorsal and ventral margins may be incised. The incisions vary from fairly slight to deep. The height of the secondary lobes may be much less than the dorsoventral thickness of the primary portion of the caecum or greater. In the latter case the secondary lobes, or caeca, are finger-shaped, and the entire caecum might almost be regarded as compound. The secondary lobes, however, are not directed anteriorly as in a glove-shaped compound caecum, but dorsally or ventrally. If both dorsal and ventral margins are deeply incised the depth of the incisions decreases passing posteriorly on the dorsal margin but increases on the ventral margin passing posteriorly.

The last pair of hearts is in xiii (3 specimens). There may be a single commissure belonging to ix on the right or the left side, or a pair of commissures. The hearts of x are closely bound against the anterior face of 10/11 by connective tissue and if empty may be difficult to find. All hearts of ix-xiii pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral (A, C, and Kellogg's specimens). The seminal vesicles of xi and xii are in contact transversely above the dorsal blood vessel. Each vesicle is provided with a primary ampulla the height of which may equal the height of the ventral lamina. The primary ampulla may be conical or columnar; the base may be merely constricted off from the ventral lamina, or the base may be wedge-shaped and sunk into the dorsal margin of the ventral lamina. In two specimens the primary ampullae are filled with parasitic masses, while none of these masses are present in the ventral portions of the vesicles. There are paired pseudovesicles in xiii and xiv, the vesicles of xiii about half the size of the vesicles in xii but about twice the size of the vesicles of xiv (3). The pseudovesicles of xiii of one specimen contain parasitic masses.

The prostates extend through xvii or xviii-xix or xx. The prostatic duct is 13-16 mm long, tapering gradually at each end, bent in an S or W shape. A middle portion about 7-9 mm in length is much thickened. In Kellogg's specimens the ducts are J- or U-shaped, the ectal limb of a loop thickened.

The spermathecal duct is stoutish, narrowed only in the outermost layers of the parietes. The diverticulum is about as long as or longer than the combined lengths of duct and ampulla.

An ental portion of the spermathecal diverticulum is usually elongate-ovoidal and definitely marked off from the remainder of the diverticulum. An ental portion of the slenderer part of the diverticulum, is, like the ovoidal part, filled with sperm and often looped into a regular zigzag, the limbs of the loops short and in apposition. The stalk portion of the diverticulum is not marked off externally from the looped portion of the seminal chamber.

Associated with each preclitellar or postclitellar genital marking is an ovoidal glandular mass. This mass may project slightly into the coelomic cavity or may be bound down to the parietes or be located within the parietes between longitudinal muscle fibers. The stalks, which are narrower than the glands, may or may not be visible within the coelomic cavity. The stalked preclitellar glands are readily recognizable in the coelomic cavity of specimen C. Only one stalked preclitellar gland is visible in the coelomic cavity of specimen B.

*Remarks.*—Lin's specimens were from Amoy and were identified by Michaelsen. According to Lin the number of setae on segments xx-xxi varies from 86 to 93.

*P. paraglandularis* is so very similar to *P. aspergillum* with regard to a number of structures of major systematic importance that there can be little if any doubt that the two are synonymous (types have not been available for study). However, in *P. paraglandularis*, according to Fang, the male pores are large slits; there are "moderate" copulatory chambers, each containing an elongate genital papilla; septum 8/9 is thickened, only 9/10 is lacking; the gizzard is between septa 8/9 and 10/11 and accordingly belongs morphologically either to ix or x; the intestinal caeca originate in xxv and extend only through one segment, there are two pairs of testis sacs, the conjoined transverse pairs connected with each other anteroposteriorly. All these rather unusual characteristics are doubtless the result of errors in observation or interpretation. It is scarcely necessary to discuss all these errors. The gizzard is always in segment viii in the genus *Pheretima*. Fang has mistaken septa 5/6-7/8 for septa 6/7-8/9. The elongate genital papilla is doubtless the transverse ridge on the male area.

Fang's figure of a male genital area would do quite well for that of one of the Hamburg specimens if the transverse ridge were lobulated instead of smooth and with genital markings. An intestinal caecum of one of the Hamburg specimens is very much like the figure of the caecum in Fang's paper.

Chen examined Fang's specimens but failed to correct the errors in Fang's account. According to Chen the hearts of x are lacking;

possibly the missing pair was overlooked owing to the coverage by connective tissue.

Specimen C is cut into two portions. The combined lengths of these parts is about 145 mm. The number of segments is 135 or 136. The posterior half of the worm is characterized by an alternate brown and white banding, especially marked on the dorsum, the setal circles on rather narrow, whitish bands, between successive white bands a broader, brownish, intersetal band. These three characteristics enable the identification of the Hamburg specimen numbered V 10472 as the holotype of *P. lawa*.

#### PHERETIMA BUCCULENTA Gates

1935. *Pheretima bucculenta* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 7 (type locality: Szechwan; type in U. S. National Museum).

1936. *Pheretima fangi*+*P. bipapillata* (not *P. bipapillata* Ude, 1905) + *P. bucculenta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, pp. 275, 286, 294 (type locality of *fangi*: Suifu, Szechwan; of *bipapillata*: Chungking, Szechwan; types of both in the Museum of the Biological Laboratory of the Science Society of China).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Szechwan, 3,000–4,000 feet, July 9–11, 1930."

*External characteristics*.—Length, 135 mm. Diameter, 6 mm.

The setae begin on ii, on which segment there is a complete circle. There is no definite midventral break in the setal circles; a middorsal break of variable width may be present. The setal numbers are vi/22, vii/22, viii/25, xvii/16, xviii/20, xix/20.

The first dorsal pore is on 12/13.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking; no setae visible.

The spermathecal pores are minute, four pairs, on 5/6–8/9.

The male pores are minute, each pore on a tiny conical tubercle in the dorsalmost portion of a parietal invagination. The parietal invaginations are deep, slitlike, with longitudinal, narrow apertures. The lateral wall is thin, and its ventral margin is liplike. Setae are lacking on the lateral wall of the invagination.

There is a pair of genital markings on xviii. Each marking is transversely oval, 4–6 intersetal intervals wide, immediately anterior to the setae, the lateralmost portion within the parietal invagination and covered over by the lateral lip. The markings are flat-surfaced, slightly protuberant, sharply demarcated, grayish, and widely separated from each other. In addition to these quite definite markings, there are in the parietal invaginations 1–3 less definite whitish patches of varying shape and size.

*Internal anatomy*.—Septa 6/7–7/8 and 10/11–11/12 are thickly muscular; 12/13 muscular; 8/9 present only ventrally; 9/10 lacking.



The intestine begins in xv. The intestinal caeca are elongate, simple, with 6-8 very definite but short and stumpy, rather broad lobes on the ventral margin, length of lobes less than dorsoventral diameter of the main portion of the sac.

There is a pair of hearts belonging to ix. The last pair is in xiii. The hearts of x are large, filled with blood, and not held against septum 10/11. All hearts of ix-xiii pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles of xi and xii are medium-sized vertical bodies, in contact transversely over the dorsal blood vessel. There is a pair of small club-shaped pseudovesicles in xiii. The prostates extend through xvii-xviii. The prostatic duct is about 4 mm in length, bent into a U-shape, the ectal half thicker than the ental half.

The spermathecal duct is rather slender, about equal in length to the ampulla from which it is not sharply marked off, only slightly narrowed within the parietes. The diverticulum passes into the anterior face of the duct close to the parietes and is short, slender, the ental portion bent in a regularly zigzagged fashion, the loops all in the same plane. The diverticula are rather small and may possibly not be fully developed.

In the parietes dorsal to each genital marking is a glandular mass that projects conspicuously into the coelomic cavity, the dorsal face of the mass rather conical.

*Remarks.*—In the coelomic cavities, the seminal vesicles, and the walls of some of the blood vessels there are numbers of parasites, which may have been responsible for a retardation in the development of the spermathecae and in particular of the spermathecal diverticula. Other organs appear to be normal.

The male parietal invaginations are very similar to those of *P. tschiliensis*, *P. praepinguis*, and *P. paeta*.

*P. bucculenta* is distinguished from other octothecal Chinese species of *Pheretima* by the combination of superficial spermathecal pores and deeply invaginate male pores.

*P. fangi* is distinguished from *bucculenta*, according to Chen (1936, p. 278), by the larger size of the genital marking in the male pore invagination, the larger size of the male pore invagination, the stout hearts of x, the coiling of the spermathecal diverticulum, and "many other characters." Slight differences in size of genital markings or of hearts, in depth of the male pore invaginations (even if existent) as well as coiling of a spermathecal diverticulum are not acceptable criteria of specific distinctness in the genus *Pheretima*. The "many other characters" (of specific value) are nonexistent so far as can be discovered from the description given by Chen. As was noted above, the type of *bucculenta* was heavily parasitized and

may not have been quite normal (*vide* note on spermathecal diverticula in description above).

*P. bipapillata* (preoccupied by *bipapillata* Ude in 1905) is not distinguished either from *bucculenta* or *fangi* by any characteristics of specific value.

**PHERETIMA CHOEINA** Michaelsen

1927. *Pheretima choeina* MICHAELSEN, Boll. Lab. Zool. Portici, vol. 21, p. 85 (type locality: Lo-choei-Tong, Yunnan; type in the Hamburg Museum).

1931. *Pheretima* (Ph.) *choeina* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 158; Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 3.

*Material examined*.—From the Hamburg Museum: Contents of a tube labeled "V 10424. *Pheretima choeina* Mich. Lo Choei Tong, Yunnan, 2.3.35. F. Silvestri leg. Michaelsen ded." The tube contains only a few internal organs, including two spermathecae.

*Remarks*.—The seminal vesicles of xi and xii are small, little if at all larger than the pseudovesicles of xiii. The left anterior vesicle is smaller than the others. The appearance of the seminal vesicles and in particular of that of the left side of xi together with the absence of the setae on x ("Borsten am 10. Segment fehlend, wenn nicht sehr klein") may perhaps be taken as evidence that the type is abnormal.

**PHERETIMA CALIFORNICA** Kinberg

1887. *Pheretima californica* KINBERG, Öfv. Vet.-Akad. Förh. Stockholm, vol. 23, p. 102 (part) (excluding octothecal specimens; type locality: Sausalito Bay, Calif.; types in the Stockholm Museum).

1912. *Pheretima browni* STEPHENSON, Rec. Indian Mus., vol. 7, p. 274 (part) (excluding sexthecal specimens; type locality: Tengyueh, Yunnan; types in the British Museum and the Indian Museum).

1927. *Pheretima modesta* MICHAELSEN, Boll. Lab. Zool. Portici, vol. 21, p. 88 (type locality: Yi-Leang, Yunnan; type in the Hamburg Museum).

1931. *Pheretima browni* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 158.

1931. *Pheretima* (Ph.) *browni* + *P. kiangensis* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 3, 21 (type locality of *kiangensis*: Soochow, Kiangsu; types in the Hamburg Museum).

1931. *Pheretima kiangensis* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 61, p. 558.

1931. *Pheretima* (Ph.) *hesperidum* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 137 (part) (excluding from synonymy *loehri* Michaelsen, 1899, and possibly though not probably *sandvicensis* Beddard, 1896; Szechwan).

1933. *Pheretima hesperidum* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 275 (Kiangsu, Chekiang, Anhwei, Kiangsi, Hupei, Hunan).

1935. *Pheretima hesperidum* CHEN, Bull. Fan Inst. Biol. Peiping, vol. 6, p. 33 (Hongkong).

1935. *Pheretima modesta* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 12.

1935. *Pheretima californica* GATES, Lingnan Sci. Journ., vol. 14, p. 452

1936. *Pheretima californica* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 270 (Szechwan).

## THE FOLLOWING PLACED DOUBTFULLY IN SYNONYMY:

1896. *Perichaeta sandvicensis* BEDDARD, Proc. Zool. Soc. London, 1896, p. 203 (Hongkong).  
 1931. *Pheretima hesperidum* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159 (excluding *Amyntas loehri* Michaelsen).  
 1931. *Pheretima* (Ph.) *hesperidum* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 2 (excluding *Amyntas loehri*).

*Material examined*.—From the Hamburg Museum: 1 specimen labeled "V 10423. *Pheretima modesta* Mich. Yi Leang, SW. China. F. Silvestri leg. 24.2.1925"; 4 specimens (A) labeled "*Pheretima kiangensis* Mich. (= *Ph. kiangsuensis* Chen) China, Soochow, Biol. Anst. Soochow 1/." From the U. S. National Museum: 3 specimens (B) labeled "*Pheretima hesperidum*, Nanking, China. Ident. by Y. Chen." From Dr. Graham: 5 specimens (C) labeled "Szechwan, 7,000 feet, August 29, 1928"; 2 clitellate specimens labeled "At Lo-Gu in the Ningyuenfu prefecture, 6,500 feet, July 22-23, 1928"; 1 clitellate specimen labeled "Suifu, 1,200-2,000 feet, October 30-November 1, 1928"; 1 clitellate specimen labeled "Suifu, 1929."

*External characteristics*.—The setal numbers of several specimens are as follows:

viii	xvii	xviii	xix	xx	Specimens
20	16	10	17	-----	A
18	22	12	19	59	
15	18	12	21	56	
16	20	11	22	-----	
15	19	12	17	-----	B
<sup>1</sup> 17	<sup>1</sup> 16	<sup>1</sup> 10	<sup>1</sup> 20	-----	
16	<sup>1</sup> 18	<sup>1</sup> 9	20	-----	
17	18	14	19	44	
17	22	16	20	43	C
18	23	17	22	47	
19	22	14	22	59	
17	18	12	17	45	

<sup>1</sup> Gaps in setal rows, setal pits present in gaps, setae possibly pulled out in removing cuticle.

The apertures of the copulatory chambers are transversely slit-like, the margins of the apertures minutely lobulated. The copulatory chambers are completely everted in the type of *modesta*. The apertures of the copulatory chambers may gape open so that the male pores are visible.

*Internal anatomy*.—The intestinal caeca are simple, the ventral margins usually with several slight incisions. The typhlosole begins just behind the intestinal caeca and extends into the gut lumen as a low but thin and bladeliike ridge.

There is a pair of hearts belonging to ix in 2 specimens; the single heart of ix on the left side (4 specimens), on the right side (3 specimens). The last pair of hearts is in xiii (9 specimens). All hearts of ix-xiii pass into the ventral blood vessel (4 specimens).

The testis sacs are unpaired and ventral (9 specimens), the sac of x often with a bilobed anterior margin.

The prostates extend through xvii-xix or xx. The prostatic duct is 2-4 mm long. An ental portion, varying in length from 2 to 3 mm, is thickly muscular, nearly straight or slightly bent into a sort of crescentic curve. An ectal portion, about 1 mm in length, is very slender but firm and bent into 1-3 tiny U-shaped quirks, which are covered over by connective tissue; only the thickly muscular portion of the duct visible on first opening the worms.

The copulatory chambers, when completely retracted, protrude rather conspicuously into the coelomic cavity. A very large portion of this coelomic protuberance is composed of connective tissue and the tiny ectal quirks of the prostatic duct. In those specimens on which the apertures of the chambers gape open the lumen of a chamber does not extend internally beyond the level of the coelomic face of the parietes and the male pore chamber appears to be simply an invagination of the parietes. In 2 specimens with chambers (apparently) fully retracted and with chamber apertures shut tight the lumen of the chamber appears to extend internally dorsal to the level of the coelomic face of the parietes though only slightly, while ectally the lumen is narrowed as if by a sphincter. The male pore invagination is accordingly termed a copulatory chamber. The actual protuberance (of the chamber not including the quirks of the prostatic duct and the connective tissue) is, however, so slight that it may be preferable to call the chamber a parietal invagination.

The spermathecal duct is narrowed in the parietes, the thicker coelomic portion about as long as or slightly shorter than the ampulla. An ectal portion of the ampulla is so firmly bound by connective tissue around the ental portion of the duct that the duct appears to be invaginated into the lumen of the ampulla. The diverticulum comprises a short stalk, which may be nearly as thick as the duct, and a longer and slightly thicker seminal chamber. The latter is nearly straight, twisted, looped, or bent in various ways.

*Remarks.*—The U. S. National Museum specimens from Szechwan are brittle and broke into pieces in the course of dissection.

There is nothing whatever in Beddard's account of his *sandvicensis* to indicate specific distinction from *californica* (types and the Hong-kong specimens). If Beddard's specimens cannot be found, *sandvicensis* will have to be regarded as a synonym of *californica*.

## PHERETIMA DIFFRINGENS (Baird)

1869. *Megascolea diffringens* BAIRD, Proc. Zool. Soc. London, 1869, p. 40 (type locality: Plas Machynlleth, North Wales; types in the British Museum).
1912. *Pheretima divergens* var. *yunnanensis* STEPHENSON, Rec. Indian Mus., vol. 7, p. 274 (type locality: Tengyueh, Yunnan; type in the Indian Museum).
1931. *Pheretima* (*Ph.*) *divergens* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 158 (part) (excluding Japanese distribution); Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 2 (part) (excluding Japanese distribution).
1931. *Pheretima* (*Ph.*) *heterochaeta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 123 (Szechwan).
1932. *Pheretima divergens* GATES, Lingnan Sci. Journ., vol. 11, p. 511.
1933. *Pheretima heterochaeta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 234 (Kiangsu, Chekiang, Kiangsi, Anhwei).
1935. *Pheretima heterochaeta* CHEN, Bull. Fan Inst. Biol. Peiping, vol. 6, p. 34 (Hongkong); Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 121 (Fukien).
1935. *Pheretima mirabilis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 12.
1935. *Pheretima diffringens* GATES, Lingnan Sci. Journ., vol. 14, p. 452.
1936. *Pheretima heterochaeta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 270 (Szechwan).

*Material examined.*—From the Indian Museum: 2 fragments labeled "*Pheretima divergens* variety *yunnanensis* Steph. Tengyueh, Yunnan. J. Coggin Brown." From the British Museum: 1 specimen from a tube labeled "*Pheretima barbadensis* 1904.10.5.1219.1228. Hongkong. coll. Beddard" and 1 specimen from a tube labeled "*Pheretima morrissi* 1904.10.5.453. Hongkong. coll. Beddard." From the U. S. National Museum: 1 specimen from a tube labeled "*Pheretima corrugata* Chen (paratypes), Kia-Ting, Szechuan. Y. Chen." From Dr. Graham: 1 clitellate specimen labeled "Mar Hai-Tang, 6,000–8,000 feet, April 14, 1928"; 2 clitellate specimens labeled "Near Mupin, 3,000–4,000 feet, July 8, 1929"; 1 clitellate specimen labeled "Near Yachow, 1,400–1,800 feet, July 3–5, 1930"; 2 clitellate specimens labeled "Mupin, 3,500–5,000 feet, July 1, 1929"; 1 clitellate specimen labeled "Kangshien, 1,300–2,000 feet, October 28–29, 1928"; 2 clitellate specimens labeled "Between Kiating and Yachau, July 8–11, 1928"; 1 clitellate specimen labeled "Suifu, 1,400 feet, April 18, 1925"; 1 clitellate specimen labeled "South of Suifu, 1,100–1,400 feet, May 14, 1924"; 1 clitellate specimen labeled "Between Gin Keo Ho and Dawei, 1,300–5,000 feet, August 1–2"; 1 clitellate specimen labeled "Tatsienlu, 12,000 feet, July 7–9, 1923"; 1 clitellate specimen labeled "Tatsienlu, August 2–4, 1923."

In the Szechwan specimens prostatic ducts are present, but prostates are entirely lacking (8 specimens), only one prostatic duct present and no prostates (1 specimen), characteristic ducts and rudimentary prostates present (1 specimen), a medium-sized prostate and a normal duct on one side, a prostatic duct only on the

other side (1 specimen), a pair of medium-sized prostates with ducts (1 specimen), a pair of fully developed prostates with ducts (2 specimens).

*Remarks.*—Stephenson's specimen of *P. divergens* is quite clearly *P. diffringens*. One of the three paratypes of Chen's *P. corrugata* also is rather obviously to be referred to *P. diffringens*.

A specimen from Tatsienlu with normal prostates is heavily infested with nematodes. The worm has a pair of large pseudovesicles in xiii.

#### PHERETIMA EXILIS Gates

1935. *Pheretima exilis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 7 (type locality: Suifu, Szechwan; type in U. S. National Museum).

1936. *Pheretima exilis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 294 (after examination of type).

*Material examined.*—From Dr. Graham: 2 clitellate specimens labeled "Suifu, Szechwan, 1929."

*External characteristics.*—Length, 68–85 mm. Diameter, 2–2½ mm.

The setae begin on ii, on which segment there is a complete circle, and are small and closely crowded. There is no definite mid-ventral gap in the setal circles; a slight middorsal gap may be present. There are six ventral setae on segment xvi. Other setal numbers are as follows:

vi	xvii	xviii	xix	xx
39	15	8	13	50
-----	10	8	11	-----

The first dorsal pore is on 12/13.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking.

The spermathecal apertures are minute, widely separated, on tiny transversely oval areas; two pairs. The pore areas appear to be on the posterior margins of v and vi; ducts of several spermathecae were pulled out from the parietes but without obtaining definite evidence as to the exact location of the pores with relation to the intersegmental furrows.

The male pores are minute, each pore on a smooth, glistening, indistinctly demarcated area, the central portion of which is slightly depressed, the depression with an open circular aperture at the bottom of which the male pores are readily visible.

The genital markings are two pairs on xvii and xix, each marking having a thick opaque rim and a grayish, concave, circular, central portion. The markings appear to be postsetal in position, but the setae are lacking on both xvii and xix immediately in front of the markings. Each marking is about 6 intersetal intervals wide transversely and is separated from the marking of the opposite side by a midventral space about equal to 13-15 intersetal intervals.

*Internal anatomy.*—Septa 5/6-7/8 are thickly muscular; 8/9 represented only by a thin ventral rudiment; 9/10 lacking; 10/11-12/13 membranous but slightly strengthened.

The intestine begins in xv. The intestinal caeca are simple with smooth margins, short, extending through 2-3 segments.

There is a pair of hearts belonging to ix. The last pair of hearts is in xiii.

There is a pair of testis sacs on the anterior face of 10/11; no transverse connection between the sacs noted. The testis sac or sacs of xi extend dorsally at the sides of the esophagus to the dorsal blood vessel and contain the hearts of xi as well as the seminal vesicles of that segment. The seminal vesicles, paired in xi and xii, are small vertical bodies. Prostates are entirely lacking in one specimen, extending through xvii-xx in the other. In the first specimen the prostatic duct is represented only by a short, soft, whitish widening of the vas deferens just as it passes into the parietes. In the other specimen the prostatic ducts are short and soft, bent into a sort of C-shape but with a tiny quirk in the duct at each end of the C.

The spermathecae of both specimens are probably abnormal; the duct-ampulla portion of the apparatus appears to be very rudimentary, while the diverticular portion seems, relatively, to be hypertrophied. The diverticulum passes into the median face of the duct-ampulla rudiment.

There is glandular material in the parietes dorsal to each genital marking, the material projecting slightly into the coelomic cavity.

*Remarks.*—The types are almost certainly abnormal (spermathecae in both specimens and prostates in one specimen). Examination of normal specimens may enable recognition of further abnormalities in the types.

At present *P. evilis* can be distinguished from other quadrithecal Chinese species of *Pheretima* with spermathecal pores on 5/6-6/7 by the inclusion of the seminal vesicles of xi within the posterior testis sacs.

## PHERETIMA FLEXILIS Gates

1935. *Pheretima flexilis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 7 (type locality: Between Gin Keo Ho and Dawei, Szechwan; type in the U. S. National Museum).

1936. *Pheretima flexilis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 295 (after examination of type).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Between Gin Keo Ho and Dawei, 1,300–5,000 feet, August 1–2."

*External characteristics*.—Length, 40 mm. Diameter, 2 mm.

The setae begin on ii, on which segment there is a complete setal circle. Setal numbers: vii/16, viii/16, xvii/10, xviii/ca. 10, xix/11.

The first dorsal pore is probably on 13/14.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows, dorsal pores, and setae lacking.

The male pores are minute, at the centers (probably) of tiny transversely oval areas in the setal circle of xviii. Each male pore area is surrounded by several concentric furrows.

The spermathecal pores are minute, on tiny, transversely oval, glistening areas; three pairs, on 6/7–8/9.

The genital markings are median, unpaired, tiny, circular tubercles, each with a definite rim and a grayish-translucent center; presetal on viii, slightly nearer to the setae than to 7/8; postsetal on xvii, close to the setae; postsetal on xviii, close to the setae.

*Internal anatomy*.—Septa 5/6–6/7 are strengthened; no septa thickly muscular; 8/9–9/10 lacking.

The intestine begins in xv. The intestinal caeca are simple; the margins smooth except for septal constrictions.

The single heart of ix is on the right side. The last pair of hearts is in xiii.

The testis sac of x is horseshoe-shaped, on the anterior face of 10/11; the ventral ends of the sac in contact but apparently not united. The testis sacs of xi are paired, erect, more or less ovoidal, vertical bodies. The lower end of a sac is on the ventral parietes, the upper end reaching or almost reaching the dorsal blood vessel. Each sac encloses a heart, a male funnel, and a seminal vesicle, as well as testicular coagulum. The testes were not identified. The seminal vesicles of xii are large, in contact transversely above the dorsal blood vessel; extending through xiii on the left side but on the right side pushing 12/13 and 13/14 back into contact with 14/15. The prostates extend through segments xvi–xx. The prostatic duct is just over 1 mm in length, glistening, erect in the coelom, practically



straight except for a very short, slender, ental portion that is not glistening and which is bent into a tiny quirk.

The spermathecal duct is very short, about one-fourth (or less) the length of the ampulla, narrowed in the parietes to a tiny conical point. The diverticulum comprises a short slender stalk and a much longer, slightly wider, thin-walled seminal chamber. The latter is variously bent, twisted, or looped.

The genital marking glands are smooth and ovoidal; the coelomic portion of the stalks fairly long and glistening.

*Remarks.*—The body wall is so transparent in places that exact enumeration of the setae is difficult.

*P. flexilis* is distinguished from *P. hupeiensis* (Michaelson, 1895) by the absence of septa 8/9–9/10 and from *P. leucocirca* Chen, 1933, by the characteristics of the testis sacs and the included seminal vesicles and hearts.

#### PHERETIMA FORNICATA Gates

1935. *Pheretima fornicata* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 9 (type locality: Tatsienlu, Szechwan; types in the U. S. National Museum).

1936. *Pheretima fornicata* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 296 (after examination of type).

*Material examined.*—From Dr. Graham: 3 clitellate specimens labeled "Tatsienlu, 12,000 feet, July 7–9, 1923"; 1 clitellate specimen in poor condition labeled "Between Gin Keo Ho and Dawei, 1,300–5,000 feet, August 1–2."

*External characteristics.*—Length, 78–90 mm (100 mm, Dawei specimen). Diameter, 4–6 mm.

The setae begin on ii, on which segment there is a wide dorsal gap in the setal circle. There is a small but fairly regular, midventral break in the setal circles; the middorsal gap usually larger but variable in width. The setal numbers are as follows:

vi	vii	viii	xvii	xviii	xix	x
17	19	18	13	9	13	-----
<sup>1</sup> 16	20	<sup>1</sup> 19	14	9	12	56
24	21	23	14	14	15	-----
26	<sup>1</sup> 23	27	19	13	<sup>1</sup> 15	-----

<sup>1</sup> In addition setal pits in which no setae were definitely recognized.

The first functional dorsal pore is on 12/13 on each specimen, but there is a porelike marking on 11/12.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking; no setae visible. There are functional dorsal pores on 13/14 and 16/17.

The spermathecal apertures are minute, four pairs on 5/6–8/9, on tiny, grayish, transversely oval markings. The intersegmental furrows are not visible on one specimen in the vicinity of the spermathecal pores. On another specimen the ventral body wall is strongly contracted, making observations on the position of the pores difficult. On the remaining specimen, it appeared at first glance as if the spermathecal apertures were on the anterior margins of segments vi–ix. But this appearance is probably due to the stronger development of a demarcating furrow at the anterior border of the pore tubercle than at the posterior border. When the spermathecal duct is pulled out from the parietes, as may easily be done, the oval area is removed, leaving an aperture with a smooth rim in the body wall that does not belong to one segment more than another. As the pore is at the center of this area it is regarded as intersegmental.

The male apertures are minute, each pore located at the center of a circular or slightly oval (transversely) disk that is clearly marked off from the parietes by a slight furrow. The disks are 2–3 intersetal intervals wide transversely or about 0.5 mm.

There are no genital markings.

*Internal anatomy.*—Septa 5/6–7/8 are thickly muscular; 8/9 is present and complete though membranous, bulged posteriorly into a funnel-shape by the gizzard, and attached centrally to the esophagus anterior to the hearts of ix; 9/10 lacking; 10/11–13/14 thickly muscular, especially the first three.

The intestine begins in xv. The intestinal caeca are simple, constricted by the septa through which they pass.

The last pair of hearts is in xiii. All hearts of ix–xiii pass into the ventral blood vessel.

The testis sac of xi is horeshoe-shaped (Tatsienlu specimens) on the anterior face of 11/12. The ventral ends of the sac are not in contact beneath the esophagus, and no communication between the ventral ends was found. The hearts of xi are contained within the testis sac and are surrounded by testicular material. A section of the dorsal blood vessel belonging to xi is also contained within the testis sac but is not surrounded by testicular material. The seminal vesicles of xi, small, vertical bodies are not contained within the testis sac but are just lateral to the outer wall of the sac. So far as can be determined from the material available, the testis sac of x is similar to that of xi, and contains the hearts of x. The testis sacs of the Dawei specimen are paired, ovoidal. The anterior sacs project anteriorly

from 10/11 in a diagonal fashion, diverging from each other anteriorly. The sacs are fairly widely separated and are without any apparent connection transversely. The posterior sacs (vesicles of xi excluded) project anteriorly from the base of 11/12 toward 10/11, which is not reached.

The seminal vesicles are small to medium-sized vertical bodies, paired in xi and xii, each vesicle with a dorsal primary ampulla, the primary ampullae of a segment in contact dorsally over the dorsal blood vessel. In segment xiii there is a pair of pseudovesicles, which may be as large as or a trifle smaller than the vesicles of xii. The prostates extend through some or all of segments xvi-xxi. The prostatic duct is 3-5 mm long, bent in a U-shape, the ectal limb much thicker than the ental limb.

The spermathecal duct is not appreciably narrowed in the parietes and is as long as or slightly longer than the ampulla. The diverticulum, which passes into the duct at the parietes or just within the parietes, comprises a long slenderly tubular stalk with an ental, spheroidal, or asymmetrical seminal chamber; the diverticulum longer than the combined lengths of duct and ampulla.

*Remarks.*—In one of the Tatsienlu specimens there are numerous parasitic bodies in the coelom.

In xiv, of the Dawei specimen, there is a pair of fairly large stalked pseudovesicles. The ovoidal portion at the dorsal end of the stalk is brownish and has a tough, thickish rather than membranous, wall. The brownish material within the vesicles comprises corpuscular bodies, setae, and nematode ova. No nematodes or coelomic Protozoa were found.

Setae as well as nematode ova have been found previously in the pseudovesicles of xiv (see, for instance, Gates, 1932, pp. 479-480).

*P. fornicata* is distinguished from *P. hongkongensis* Michaelsen, 1910, by the dorsal gap in the setal circle of ii, the absence of genital markings, and the exclusion of the anterior seminal vesicles from the testis sac of xi.

According to Chen (1936, p. 298) *P. fornicata* "is probably identical with *P. pingi* Steph." *P. fornicata* is, on the contrary, clearly distinguished from *P. pingi* by the horseshoe-shaped testis sacs of x and xi. Chen, however, thinks that the testis sacs are "connected ventrally and communicated" rather than as described above. Even if the ventral ends of the "horseshoe-shaped testis sac" are in communication as Chen suspects, the annular testis sac thus formed will still distinguish *fornicata* from *pingi*.

## PHERETIMA GRAHAMI Gates

1935. *Pheretima grahami* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 9 (type locality: Da Shiang Lin Pass, Szechwan; types in the U. S. National Museum).
1936. *Pheretima grahami* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 298 (after examination of types).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Da Shiang Lin Pass, 7,000 feet, August 29, 1928"; 1 clitellate specimen labeled "Ningyuenfu, 7,000 feet, July 1928."

*External characteristics*.—Length, 235–285 mm. Diameter, 11–15 mm.

The setae begin on ii, on which segment there is a complete circle. There are no definite midventral gaps in the setal circles; middorsal gaps may be present but are of variable width. Setal numbers: vii/22–25, viii/22–27, xvii/10(+?)–26, xviii/10(+?)–19, xix/19(+?)–25, xx/80–91. (The first number of each pair is from the specimen with the first dorsal pore on 13/14.)

The first dorsal pore is on 12/13 or 13/14.

The clitellum is annular and extends from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking on one specimen, slight vestiges of both on the other specimen. Setae are present, at least midventrally, on xiv–xvi of one specimen; lacking on the other.

The secondary spermathecal pores are widely separated; three pairs, on 6/7–8/9. Each pore is a wide transverse slit; the margin of the slit finely lobulated. On separating the margins of an aperture a deep invagination passing posteriorly (never anteriorly) into vii or viii or ix becomes visible. On the median wall of the invagination there is a finely lobulated ridge. On the roof of the invagination there is a large, oval, genital marking, a portion of which may be visible from the exterior if the margins of the aperture are pulled sufficiently apart. The wall of the spermathecal invagination is extensively and finely wrinkled or furrowed, sometimes with an appearance of cross-hatching.

The apertures of the copulatory chambers are somewhat irregular but approximately transversely slitlike. There is no lateral lip; the body wall just lateral to the aperture thick.

Genital markings are lacking externally.

*Internal anatomy*.—Septa 5/6–7/8 are thickly muscular; 8/9–9/10, lacking; 10/11–12/13, thickly muscular; 13/14, muscular.

The intestine begins in xv. The intestinal caeca are simple; the dorsal and ventral margins without incisions; or the ventral margin may be incised in such a way as to form 4–6 widely separated, ventrally directed, short fingerlike lobes. On the esophagus just behind the gizzard there is a conspicuous, lobed, reddish, glandular collar.

There is a pair of commissures belonging to ix or a single commissure on the left side. The last pair of hearts is in xiii (2 specimens). All hearts of ix-xiii pass into the ventral blood vessel.

The testis sacs of x and xi are ventral and unpaired. The seminal vesicles of xi and xii are firm vertical bodies filling their segments and in contact transversely above the dorsal blood vessel. In xiii and xiv of one specimen there are paired pseudovesicles, the vesicles of xiv of about the same size as the vesicles of xiii. The prostates extend through xvii-xix. The prostatic duct is about 10 mm long, bent into a C-shape; the ectal two-thirds much thickened. On the floor of xviii on each side and just median to the ectal end of the prostatic duct is a large glandular mass, which can be separated with care into several discrete glands, from each of which a bundle of cords or ducts passes to a genital marking. In each copulatory chamber there are 5 or 6 genital markings; the markings circular to oval, flat-surfaced but protuberant. The minute male pore is on a rather flattened out but still conelike plate or tubercle, which is smaller than the genital markings.

The spermathecal duct is stoutish, shorter than the ampulla, narrowed very abruptly within the parietes just lateral to the glandular mass on the spermathecal chamber. When the duct is pulled out carefully from the parietes a circular area, the surface of which is nearly level with the coelomic face of the body wall, becomes visible. At the center of this area there is a tiny depression from which the narrowed portion of the duct has been removed. The diverticulum, which passes into the median face of the duct close to the parietes comprises a firm, glistening stalk and a longer, thin-walled, seminal chamber. The latter may be looped in a regularly zigzag fashion, the limbs of the loops in apposition. The diverticulum (in the looped condition) is as long as or longer than the combined lengths of the duct and ampulla.

The spermathecal chamber is large, club-shaped, narrowed toward the parietes (i. e., ectally), bent backward and bound to the coelomic floor by connective tissue. This tissue, however, can be cut readily so that the chamber is separated from the ventral parietes. The posterior wall of the chamber (that in contact with the ventral parietes) is thin. On the anterior face of the chamber is a large flattish mass of glandular tissue, oval in outline. From this glandular mass ducts pass to the large, oval, genital marking within the spermathecal chamber. The circular area, with a central depression which becomes visible on removal of a spermatheca, is the dorsal face of a thick tough column of tissue, which passes into the lateral wall of the spermathecal chamber. The narrowed portion of the spermathecal duct is continued through this column to open to the ex-

terior by a minute pore on the tip of a tiny conical protuberance on the lateral margin of the large genital marking in the spermathecal chamber.

*Remarks.*—One of the specimens is in a much poorer state of preservation than the other. The epidermis is also damaged; the setal counts on the first three postclitellar segments are incomplete. The description of the internal anatomy was derived mainly from the poorer specimen in order to keep the internal organs of the better specimen in good condition for future reference.

In the coelomic cavities of both specimens there are nematodes and spheroidal, cystlike bodies. In one of the worms there are cysts of another sort in the esophageal, postgizzard collar.

*P. grahami* is distinguished from *P. vulgaris* Chen, 1930, by the ventral, unpaired testis sacs of x and xi, the larger size of the spermathecal chamber, the posterior direction of the chamber, the attachment of the chamber to the ventral parietes, and the single large genital marking within the chamber.

Chen (1936, p. 299) maintains (1) that the "so-called" spermathecal chamber of *grahami* is not homologous with the "parietal invagination of *P. vulgaris*" and (2) that *P. grahami* is a synonym of *P. tschiliensis* Michaelsen 1928:

(1) The remark about homology has no significance. In *P. vulgaris* the spermathecal pore is not in a "parietal invagination" but within a spermathecal chamber (an invagination that extends through the parietes into the coelomic cavity). In fact the term spermathecal chamber was first used in Chen's original description of *vulgaris*. The confusion is due, in part at least, to Chen's failure to discriminate between *vulgaris* (copulatory chambers and U-shaped testis sacs) and *P. guillelmi* (Michaelsen, 1895) (male pore invaginations and ventral testis sacs).

(2) Examination of the types of *tschiliensis* (*vide* description on a subsequent page) has shown that in Michaelsen's species the primary spermathecal pores are superficial. At most the marking that bears the spermathecal pore may be slightly depressed. There is no definite invagination. In *P. grahami*, on the other hand, the primary spermathecal pore is contained within an invagination so large that it not only passes through the parietes into the coelomic cavity but extends posteriorly on the ventral parietes well toward the septum next behind. Such an unusual structure certainly distinguishes *grahami* from any species with superficial spermathecal pores. The copulatory chambers further distinguish *grahami* from *tschiliensis* or any other species with male pores in invaginations restricted to the parietes.

## PHERETIMA GUILLELMI (Michaelsen)

1895. *Perichaeta guillelmi* MICHAELSEN, Abh. Nat. Ver. Hamburg, vol. 13, no. 2, p. 32, (type locality: Shi-hui-yao near Wuchang, Hupei; types in the Hamburg Museum).
1925. *Pheretima houletti* STEPHENSON, Proc. Zool. Soc. London, 1925, p. 890 (Nanking; specimens in the British Museum).
1930. *Pheretima vulgaris agricola* CHEN, Sci. Rep. Nat. Cent. Univ. Nanking, ser. B, vol. 1, p. 18 (part only ?) (type locality: Nanking ?; types ?).
1931. *Peretima houletti* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159 (part only ?) (excluding *houletti* Michaelsen, 1899 ?).
1931. *Pheretima* (*Ph.*) *houletti* MICHAELSEN (part only ?) (excluding *houletti* Michaelsen, 1899 ?) + *P. guillelmi* Michaelsen, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 2, 13.
1932. *Pheretima guillelmi* GATES, Lingnan Sci. Journ., vol. 11, p. 511.
1933. *Pheretima guillelmi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 249 (part) (excluding *P. vulgaris* in part, forms with copulatory chambers).
1933. *Pheretima ichangensis* FANG, Sinensia, vol. 7, p. 180 (type locality: Ichang, Hupei; types in the Metropolitan Museum of China).
1935. *Pheretima guillelmi* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 10.

## THE FOLLOWING PLACED DOUBTFULLY IN SYNONYMY:

1899. *Amyntas houletti* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 16, p. 12.
1936. *Pheretima guillelmi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 270 (Szechwan).

*Material examined.*—From the Hamburg Museum: 6 specimens labeled "*Pheretima* (*Ph.*) *guillelmi* Mich. W. Lohr 1. d. China. Prov. Hupei. Original Stucke." From the British Museum: 4 clitellate specimens labeled "*P. Houletti*." From the Metropolitan Museum of China: 2 dissected clitellate specimens labeled "*P. ichangensis* Fang. Ichang. Hupeh. 1929." From the U. S. National Museum: 2 a clitellate and 15 clitellate specimens labeled "Kiangsu-Nanking. National Southeastern University by C. Ping."

*External characteristics.*—Length, 96–150 mm. Diameter, 5–8 mm.

The setae begin on ii, on which segment there is a complete circle. Setae of the preclitellar segments are enlarged, especially ventrally, the size decreasing posteriorly; regularly spaced. Middorsal and midventral gaps may be entirely lacking in the setal circles; the mid-dorsal gaps, when present, variable in width; a midventral break, when present, very slight. The setal numbers are as follows:

vii	viii	xvi	xviii	xix	xx	Locality
12	13	14	14	18	54	Hupei (?). (?).
15	16	18	17	18	56	
		20	19	19		
		15	15	17	59	
18	19	17	15	17	55	Nanking
		18	15	17	60	
17	17	18	16	17		
17	17	20	19	18		
18	19	21	16	19		(?). (?).
16	17	20	15	18	61	
17	18	19	14	16	55	
19	21	21	15	21		
16	16	17	13	16		Ichang.
16	17	18	18	20	57	
21	22	22	21	22		
16	18	20	20	21	64	
13	13		15		54	Nanking (Brit. Mus.)
12	14	16	15	16	60	
14	18	18	14	16	44	
16	16	17	19	19		
15	16	18	15	18		
19	21	20	18	20	54	
17	18	18	15	20	53	
15	18	17	17	20	59	

<sup>1</sup> Achetellate

<sup>2</sup> Several gaps in which setal pits are visible but apparently no setae in the pits.

The first dorsal pore is on 12/13 (29 specimens).

The clitellum is annular, extending from 13/14 to 16/17; setae lacking on fully clitellate specimens, present ventrally on one partially clitellate specimen. Functional dorsal pores or nonfunctional porelike markings and slight indications of intersegmental furrows are visible on several specimens on which the clitellar glandularity may not have reached full development. There are functional dorsal pores on 13/14 and 16/17.

The secondary spermathecal pores are transverse slits opening into deep pits, 3 pairs, on 6/7–8/9.

The apertures of the male pore invaginations are crescentic, the concave side facing midventrally. In many of the rather soft Nanking specimens the apertures gape open, disclosing more or less of the median wall of the invagination. The invaginations are rather shallow. The lateral lip or wall is thin and lacks setae. The median wall of the invagination is firmer than the lateral wall and is ridged, the ridge in line with the male setae and cut up, as a rule, by short furrows into fine lobes. On these lobes or between the lobes there are setae, usually 2–3 in each invagination, which have been included in the male setae in the preceding table. The setae are 0.49–0.61 mm long, straight or slightly sigmoid, with a slight bend of the ental ends, the ectal tips narrowing gradually to a bluntly



rounded end and ornamented with short transverse rows of very fine teeth.

The tips of about a quarter of the setae examined are very shortly bifid. On all except one of the fully clitellate specimens there is, on each side, a short gap in the setal circle just median to the aperture of the invagination. The setae within the invagination are thus slightly isolated from the other male setae. Just lateral to the lobulated ridge and in the dorsalmost portion of the invagination is a single, bluntly rounded, rather mammalike smooth and glistening tubercle. On the ventral face of the tubercle is the minute male pore. In one of the Hamburg specimens each male pore is on a transversely oval, flat area. There are no definite genital markings or papillae within the invagination aside from the male pore tubercle. The lobulations of the median ridge sometimes look much like genital markings or tubercles, especially in one worm where one of the lobulations in each invagination has been crowded anteriorly into a position just in front of the main portion of the ridge. No pores have been found on these lobulations or demarcation into rims and central areas as on genital markings associated with glands.

The only genital markings are tiny circular tubercles in close proximity to the spermathecal apertures, usually but one of these markings associated with each aperture, rarely two. The marking is on the anteriormost margin of the segment just at or actually within the secondary spermathecal aperture. The marking sometimes appears to be just median to the aperture. Perhaps a more complete retraction of the spermathecal chamber would result in retracting the marking into the parietes. When two markings are visible in connection with any spermathecal pore, one is always within the aperture. In one specimen the marking in connection with each spermathecal aperture is on the posteriormost margin of the segment and immediately in front of the aperture.

*Internal anatomy.*—Septa 5/6–7/8 are thickly muscular; 8/9–9/10 lacking; 10/11–12/13 thickly muscular; 13/14 muscular; 14/15 slightly muscular.

The intestine begins in xv (18 specimens). The intestinal caeca are simple but the ventral margins, especially posteriorly, are slightly incised in such a way as to produce an appearance of a row of very short but definite lobulations. There is a small, whitish, occasionally lobed, glandular collar on the esophagus just behind the gizzard.

The single heart of ix is on the right side in 8 specimens, on the left side in 6 specimens. The hearts of x are present in all specimens but are often concealed by the connective tissue that binds

them to the anterior face of 10/11. The last pair of hearts is in xiii (18 specimens). All hearts of ix–xiii pass into the ventral vessel.

The testis sacs of x and xi are ventral and unpaired. The seminal vesicles of xi and xii fill their segments and reach into contact transversely above the dorsal vessel. Each vesicle is provided with a primary ampulla, which may be constricted off by a circumferential furrow from the ventral lamina or the base of the primary ampulla may be narrowed or flattened and sunk into the dorsal margin of the ventral lamina. The primary ampulla may reach a length equal to one third of that of the entire vesicle.

The prostates extend through xvi or xvii to xix, xx, or xxi. The prostatic ducts are 6–10 mm long, each duct usually bent into a hairpin-shape, with the ectal limb much thicker than the ental limb. In a few specimens the loop is more open so that the duct has a C-shape. The thick portion of the duct at first appears to pass directly into the parietes, but if connective tissue around the duct near the parietes is carefully dissected off a much slenderer portion, bent into one or two tiny, very short U-shaped quirks, becomes visible.

No stalked glands or glandular masses can be found on the parietes or within the parietes in the vicinity of the prostatic ducts.

The spermathecal duct is smooth, the coelomic portion of about the same diameter throughout and about equal in length to the ampulla. The diverticulum passes into the anterior face of the duct close to the parietes; ectal to this junction the duct is much narrowed. The diverticular stalk is slender, smooth, and firm, about equal in length to the coelomic portion of the spermathecal duct or slightly shorter, always shorter than the seminal chamber. The latter is wider than the stalk, thin-walled and zigzag looped, apparently within a delicate, transparent, connective tissue sac or investment. The limbs of the loops are very short and in contact. Usually all except two or three of the loops are in the same plane. In one specimen all seminal chambers are straight and without any trace of looping or constriction.

If the spermathecal duct is grasped firmly at its junction with the diverticulum and carefully and slowly pulled out from the parietes, a small circular patch of tissue becomes visible which projects slightly into the coelomic cavity. At the center of this patch is a tiny concave depression from which the narrowed portion of the spermathecal duct has been removed. The circular patch of tissue is the thin dorsal wall of a spermathecal chamber, which is almost entirely confined to the parietes. Within the spermathecal chamber are the genital markings or tubercles (one or rarely two)

and a tiny protuberance on which the minute, primarily spermathecal pore is located. This protuberance does not appear to be definitely demarcated as are the genital markings. Closely associated with each spermathecal chamber are one or two stalked glands. The stalk of the median gland passes into the parietes at the side of the spermathecal chamber and to the genital marking visible externally just at the mouth of the chamber. The stalk of the posterior gland passes into the posterior wall of the chamber and to the genital marking that is deepest within the chamber. A third gland when present may be lateral or anterior to the spermathecal chamber. If only one gland is present it is always posterior. The stalks of the glands may be short and practically confined to the body wall or much longer and with a definitely coelomic portion. The junction of the spermathecal duct and the dorsal face of the spermathecal chamber is covered over with connective tissue and unless this tissue is dissected off the duct has the appearance of passing into the parietes undiminished in diameter.

(NOTE: As the spermathecal pore invagination appears to pass through the parietes into the coelomic cavity the invagination is called a spermathecal chamber, but the chamber is small, especially in comparison with that of *P. grahmi*.)

*Remarks.*—The Hamburg specimens are very stiff and brittle, the body wall so transparent that recognition of the external characteristics is difficult. The brittleness was overcome by a short period of soaking in water, but prolongation of the soaking results in a gelatinization of the organs.

On the smallest acitellate specimen the male pore areas are small, transversely oval patches in the setal circle, which are not clearly demarcated from the neighboring portion of the ventral surface. The male pores, however, can be recognized at the centers of these areas. On a slightly larger specimen the margin of each male pore area is clearly demarcated, except mesially, by a crescentic or U-shaped furrow, the concave side of the crescent or of the U facing midventrally. The deepening of this furrow produces the parietal invagination which is also crescentic to U-shaped in section. The sites of the spermathecal apertures on the acitellate specimens are represented by tiny, almost minute, depressions on the intersegmental furrows.

One of the U. S. National Museum specimens is abnormal, having a prostate, duct, and male pore invagination in segment xix rather than xviii on the left side.

In one of the Hamburg specimens there are a number of coelomic nematodes. In four of the U. S. National Museum specimens there are numbers of gregarinoid Protozoa in the coelomic cavities through-

out the postcelitellar segments. In one of these worms there are on the ducts of two of the spermathecae a number of vesicular outgrowths similar to those recorded by Michaelsen and Stephenson from *P. pingi*.

The British Museum specimens are not labeled, except for the notation "*P. houlleti*" on the invoice, but they were forwarded by Dr. C. C. A. Monro, of the British Museum, in reply to a request for Stephenson's specimens of *P. houlleti* from Nanking. The worms are characterized by the presence of setae in the male pore invaginations and by the posterior location of the spermathecal stalked glands but differ from other specimens of *P. guillelmi* in the presence of glandular material on the parietes just median to the ectal ends of the prostatic ducts. No definite genital markings were noted in the male pore invaginations. The first functional dorsal pore is on 12/13 on each of the four specimens, but on 2 specimens there is a porelike marking on 11/12.

The specimens of *P. ichangensis* have been compared side by side with Stephenson's specimens of *P. houlleti* (= *P. guillelmi*) and with the specimens of *P. guillelmi*. The only difference that was found was the presence in both specimens of *P. ichangensis*, in xviii median to the prostatic duct, of a stalked gland opening to the exterior by a pore on a rather indefinite genital marking in the male pore invagination. Retention of *P. ichangensis* on the basis of such an unimportant characteristic can scarcely be justified.

Michaelsen's 1899 specimens of *Amyntas houlleti* appear to have been lost; at least they are not in the Hamburg Museum. The Tientsin record is based on a simple "Fundnotiz" without description. It is accordingly impossible to determine what species Michaelsen actually had, but in the absence of any valid record of the occurrence of *P. houlleti* in north China and in view of the confusion of *P. guillelmi* with *P. houlleti* it seems possible that the Tientsin specimens were *P. guillelmi*.

*P. guillelmi* is distinguished from *P. houlleti* with which it has been confused by the restriction of the male pore invaginations to the parietes, the conformation of the male porophore, and the presence of setae within the male pore invagination.

#### PHERETIMA HAWAYANA (Rosa)

1891. *Perichaeta hawayana* ROSA, Ann. Nat. Hofmus. Wien, vol. 6, p. 396 (type locality: Hawali; type in the Vienna Museum).  
1896. *Perichaeta hawayana* BEDDARD, Proc. Zool. Soc. London, 1896, p. 201 (Hong-kong).  
1912. *Pheretima hawayana* STEPHENSON, Rec. Indian Mus., vol. 7, p. 276 (Teng-yueh, Yunnan).

1931. *Pheretima* (Ph.) *hawayana* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159 (part) (excluding quadrithecal forms); Zool. Jahrb. (Abt. Syst.), vol. 61, p. 574 (Hongkong and Canton; Berlin Museum); Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 3 (part) (excluding quadrithecal forms).
1931. *Pheretima* (Ph.) *hawayana* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 142 (part) (excluding synonymy of quadrithecal forms; Szechwan).
1932. *Pheretima hawayana* GATES, Lingnan Sci. Journ., vol. 11, p. 512 (part) (excluding quadrithecal forms).
1933. *Pheretima hawayana* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 238 (Chekiang).
1935. *Pheretima hawayana* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 121 (Amoy); Bull. Fan Inst. Biol. Peiping, vol. 6, p. 33 (Hongkong).

THE FOLLOWING PLACED DOUBTFULLY IN SYNONYMY:

1910. *Pheretima hawayana* var. *barbadensis* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 27, p. 102 (Foochow).
1927. *Pheretima hawayana* MICHAELSEN, Boll. Lab. Zool. Portici, vol. 21, p. 84 (Yunnan). (According to MichaelSEN the setae are enlarged on iv-viii, which may perhaps be regarded as an indication that the worm actually is *hawayana*, but the number of spermathecae is not mentioned.)

*Material examined*.—From the British Museum: 3 specimens from a tube<sup>2</sup> labeled "*P. barbadensis* 1904.10.5.1219.1228. Hongkong coll. Beddard" (an additional label inside the tube is as follows: "*Pheretima barbadensis* and varieties?"); 4 specimens from a tube labeled "*P. morrisi* 1904-10.5.453. Hongkong coll. Beddard"; and 2 specimens labeled "*Pheretima hawayana* forma *typica*. (1925.55.12.12/13. Tengyueh, Yunnan. Indian Museum." From Dr. Graham: 1 specimen labeled "Suifu, April 1923"; 1 specimen labeled "Suifu, 1,000-1,500 feet, May 21-26, 1930"; 1 specimen labeled "South of Suifu, 1,200 feet, May 11, 1924"; 1 specimen labeled "Suifu, June 1924"; 1 specimen labeled "Between Suifu and Kiating, 1,000-1,400 feet, June 26-July 3, 1930."

PHERETIMA HONGKONGENSIS MichaelSEN

1910. *Pheretima hongkongensis* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 27, p. 107 (type locality: Hongkong; type in the Hamburg Museum).
1931. *Pheretima* (Ph.) *hongkongensis* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159; Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 2.
1935. *Pheretima hongkongensis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 10.

<sup>2</sup> The first tube from the British Museum contains specimens of *P. hawayana*, *P. morrisi*, *P. diffringens*, and a species of *Pheretima* with spermathecal pores on 7/8-8/9. The second tube contains specimens of *P. hawayana*, *P. morrisi*, and a species of *Pheretima* with spermathecal pores on 7/8-8/9. A third tube labeled "*Pheretima barbadensis* 1914.10.5.1347.54. Calcutta coll. Beddard" contains specimens of *P. morrisi*, *P. houlleti*, and *P. posthuma*.

*Material examined.*—From the Hamburg Museum: 1 clitellate specimen in good condition labeled "V 9084. *Pheretima hongkongensis* Mich. Cohn. Hongkong."

*External characteristics.*—The setae are small, closely and regularly spaced; they begin on ii, on which segment there is a complete circle. Setal formula: vi/21, vii/20, viii/8+, xvii/17, xviii/7, xix/15, xx/58+? (xiv/4, xv/2, xvi/7). The body wall has been ruptured or abraded midventrally at several places, among which is included segment xx. There are gaps ventrally in the setal circle of viii, possibly due to the falling out of setae.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking or not clearly indicated; setae present ventrally. The clitellum is dull and roughish, not smooth and glistening, apparently not fully developed.

The first dorsal pore is on 11/12.

The spermathecal pores are minute, transverse slits, four pairs, each pore at the center of a very small, smooth, transversely oval area.

The male pores are minute, each pore a trifle lateral to the center of a male pore marking. The latter is nearly but not quite circular in shape,  $1\frac{1}{2}$ –2 intersetal intervals wide transversely, slightly protuberant but with a rather flat surface and surrounded by a slight but definite circumferential furrow. Just median to each male pore marking is a single transversely oval genital marking with a conspicuously protuberant, whitish rim and a depressed, grayish, central area; 2–3 intersetal intervals wide transversely. The genital marking is not in actual contact with the male pore area though close to it.

*Internal anatomy.*—Septum 8/9 is present at least as a ventral rudiment.

The intestinal caeca are simple, without marginal incisions or septal constrictions. The typhlosole projects conspicuously into the gut lumen as a bladelike ridge beginning with the first postcaecal segment. On the ventral face of the typhlosole is a large blood vessel distended with blood.

The last pair of hearts is in xiii. There are masses of nephridia in v and vi and large lymph glands in the intestinal segments.

The testis sac of x is unpaired and ventral. The testis-sac of xi is U-shaped, the limbs of the U reaching to the dorsal blood vessel. The seminal vesicles of xi are within the testis sac of xi, surrounded by a thin layer of testicular coagulum. There is only a small quantity of testicular coagulum in the testis sac of x.

The seminal vesicles are medium-sized vertical bodies, each with a deep dorsoventral groove on the posterior face. Each vesicle is

provided with an elongate, more or less fingerlike, primary ampulla, the base of which is sunk deeply into a cleft in the dorsal margin.

The prostate ducts are 6–8 mm in length, muscular, but uniformly slender throughout, i. e., without special thickening of an ectal portion.

The spermathecae are flattened out on the ventral parietes. The duct is much shorter than the ampulla, almost triangular in outline. The diverticulum, which passes into the anterior face of the duct just at or within the parietes, is a slender, elongate-tubular structure. In an ectal stalk portion of the diverticulum (about one-half or more of the length) the lumen is narrow; the wall of the lumen smooth or ridged transversely. In the remaining ental portion of the diverticulum the lumen gradually widens until the wall becomes very thin. This ental portion is doubtless the seminal chamber, but it is not noticeably wider than the stalk nor marked off from the stalk. Within the seminal chamber is an elongate, opaque, firm mass with no spermathecal iridescence, the mass composed of corpuscular bodies and smaller, homogeneous, spheroidal to ovoidal particles. Several bodies, apparently nucleated, that may be parasites were also noted.

Dorsal to each genital marking a glandular mass projects through the parietes and very slightly into the coelomic cavity, the glandular material just median to the ectal end of the prostatic duct.

*Remarks.*—Michaelsen (1910, p. 107) referred to the holotype as "ein vollständiges geschlechtsreife Exemplar." The clitellar glandularity is almost certainly not fully developed and this together with the small quantities of testicular coagulum in the testis sacs indicates that the worm is either not quite normal (also note spermathecae) or not completely sexual (presexual or postsexual).

Although the gut, septa, and attached organs of the anterior segments had been dissected from the worm, dissection and preservation were such that determination of the characteristics of the testis sacs was not difficult.

**PHERETIMA HUPEIENSIS (Michaelsen)**

1895. *Perichaeta hupeiensis* MICHAELSEN, Abh. Naturw. Verein Hamburg, vol. 13, no. 2, p. 35 (type locality: Shi-hui-yao near Wuchang, Hupei; types in the Hamburg Museum).
1899. *Amyntas hupeiensis* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 16, p. 6 (previous misstatement as to number of spermathecae corrected).
1910. *Pheretima hupeiensis* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 27, p. 102 (Foochow).
1931. *Pheretima* (Ph.) *hupeiensis* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159; Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 3.

1931. *Pheretima* (*Ph.*) *hupeiensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 122 (Szechwan).  
1933. *Pheretima hupeiensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 251 (Kiangsu, Chekiang, Anhwei, Kiangsi).  
1935. *Pheretima hupeiensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 121 (Amoy).  
1935. *Pheretima hupeiensis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 11.  
1936. *Pheretima hupeiensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 271 (Szechwan).

*Material examined*.—From the Hamburg Museum: 1 clitellate specimen labeled "V 9086. *Pheretima hupeiensis* Mich. Cohn. Futschau."

*External characteristics*.—The setae begin on ii, on which segment there is a complete setal circle. The setae are small and closely crowded both dorsally and ventrally, and the circles are without definite middorsal or midventral breaks. Setal formula: vii/15, viii/19, xviii/18, xx/ca.85. There is a row of setae ventrally on each of the clitellar segments; xiv-10, xv-9, xvi-14, the row on xiv with a midventral break just behind the female pore.

The first dorsal pore is on 11/12.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking.

The spermathecal pores are minute, segmental in position, on the anteriormost margins of vii, viii, and ix; each pore on a very small, slightly protuberant, rounded knob.

The male pores are superficial, each pore at the center of a small, nearly circular, grayish area, the pore itself in a slight transverse depression. The male pore areas are located in the setal circle of xviii and are not very sharply marked off from the neighboring portions of the body wall.

The genital markings are two pairs, on 17/18 and 18/19, the intersegmental furrows ending abruptly against the bases of the markings. Each marking is slightly elevated, flattened, with a grayish translucent appearance, the rim slightly more opaque than the center. The center of a genital marking is very slightly median to the center of the male pore area. The markings are transversely oval to almost circular and about 3-5 intersetal intervals wide transversely.

*Internal anatomy*.—All septa from 5/6-13/14 are present and more or less thickly muscular.

The intestinal caeca are simple, both dorsal and ventral margins smooth. The intestine begins in xv. There is a small but definitely lobed, glandular collar on the esophagus in ix, just behind 8/9.



Both hearts of ix are present. The last pair of hearts is in xiii. All hearts of ix-xiii pass into the ventral vessel.

The testis sac of x is U-shaped; the limbs of the U passing dorsally at the sides of the esophagus contain the hearts of x. The testis sac of xi is also U-shaped and the limbs of the U contain in addition to the hearts of xi the seminal vesicles of that segment. The prostatic ducts are C- or S-shaped.

The last two pairs of spermathecae are in viii, one pair opening to the exterior posteriorly. The spermathecal duct is shorter than the ampulla, the coelomic portion stoutish and rather definitely marked off from the ampulla. The parietal portion of the duct is much narrower than the coelomic portion. The diverticulum passes into the duct in the parietes. When the spermatheca is pulled out from the parietes the ectal ends of the duct and diverticulum are surrounded by soft whitish tissue, which can be easily dissected off. The diverticulum is much longer than the combined lengths of the duct and ampulla and comprises a short, firm, glistening, slenderly tubular stalk, which is a trifle longer than the duct and a much longer and wider seminal chamber with a thin, wrinkled wall.

There is softish glandular material in the parietes dorsal to each of the genital markings, but this material does not project conspicuously into the coelomic cavity and is not visible until after the removal of connective tissue.

*Remarks.*—The original material has not been examined.

In the original description the spermathecal pores were said to be two pairs on 7/8-8/9. In the 1899 paper, after reexamination of the original material this was corrected to three pairs on 6/7-8/9.

According to Chen (1931) the spermathecal pores are on the inter-segmental furrows, but behind each pore and on the anterior margin of the segment is a "bun-shaped papilla." If Chen's specimens are like the Hamburg worm the spermathecal pore is in reality on the papilla. Chen found "about 10" setae on viii between the spermathecal pore lines.

#### PHERETIMA IGNOBILIS Gates

1935. *Pheretima ignobilis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 11 (type locality: Ningyuenfu, Szechwan; type in the U. S. National Museum).

1936. *Pheretima ignobilis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 299 (after examination of type).

*Material examined.*—From Dr. Graham: 1 acitellate specimen labeled "Near Ningyuenfu, 7,000 feet, July 28, 1928."

*External characteristics.*—Length, 55 mm. Diameter, 3 mm.

The setae begin on ii, on which segment there is a complete circle. Setal formula: vi/17, vii/16, viii/16, xvii 15, xviii 9, xix/16.

The first dorsal pore is on 11/12.

The secondary spermathecal apertures are transverse slits, four pairs, on 5/6–8/9.

In the setal circle of xviii on each side there is a transversely slit-like depression. The margin of the slit is smooth and glistening. External to the smooth circumferential lip there are several concentric circumferential furrows. The male pores are tiny slits, each pore on the roof of the depression and close to the median margin.

There are no genital markings.

*Internal anatomy.*—Septa 8/9–9/10 are lacking.

The intestine begins in xv. The intestinal caeca are simple, but from the ventral margin of the caecum there protrude ventrally several short, stumpy, fingerlike lobes, the dorsoventral length of these lobes is less than the dorsoventral diameter of the main portion of the caecum.

There is a single heart belonging to ix, on the left side. The last pair of hearts is in xiii. All hearts of ix–xiii pass into the ventral blood vessel.

On the anterior face of 10/11 is a pair of conical, anteriorly directed, ventral testis sacs, the sacs not in contact but not widely separated. There is also a pair of ventral testis sacs in xi. The seminal vesicles are vertical bodies, each with a primary ampulla reaching to the dorsal blood vessel. In segment xiii is a pair of relatively large pseudovesicles. The prostates extend through xvii–xix. The prostatic duct is short, bent into a C-shape, the ectal portion thicker than the ental portion.

The spermathecae are juvenile. The coelomic portion of the duct is of about the same thickness as the ampulla and of about the same length, but within the parietes the duct becomes thicker and its lumen wider. The diverticulum, which passes into the anterior face of the duct in the parietes and which is as long as or slightly longer than the duct and ampulla together, is slenderly tubular with just a slight suggestion of a spheroidal widening of the ental end.

*Remarks.*—No parasites were found. The worm appears to be normal.

*P. ignobilis* cannot be adequately characterized at present. It is, however, distinguished from all octothecal Chinese species of *Pheretima* by the presence of spermathecal pore (parietal only?) invaginations, with large, transversely slitlike, secondary, apertures.

#### PHERETIMA LIMELLA Gates

1935. *Pheretima limella* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 11  
(type locality: Suifu, Szechwan; types in the U. S. National Museum).  
1936 *Pheretima limella* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, pp. 272, 299 (Szechwan; after examination of type).

*Material examined.*—From Dr. Graham: 1 clitellate specimen labeled "Suifu, 1922"; 1 aclitellate specimen labeled "Suifu, December 7-10."

*External characteristics.*—Length, 60-85 mm; the longer of the two specimens is incomplete posteriorly. Diameter,  $2\frac{1}{2}$ -5 mm.

The setae begin on ii, on which segment there is a complete circle. The setae are small, closely crowded, and difficult to count; the setal circles unbroken either at the midventral or middorsal lines. The setal numbers are as follows, the first of the two specimens being the clitellate:

v	vi	xvii	xviii	xix
38	-----	18	14	18
-----	51	29	21	26

The first dorsal pore is on 12/13 (2 specimens).

The smaller specimen is apparently fully clitellate, the clitellum annular, extending from 13/14 to the setae of xvi. Intersegmental furrows and dorsal pores are lacking; setae present on xvi at least ventrally, a few scattered setae on xiv and xv. There is no trace of clitellar glandularity on the larger specimen.

The spermathecal pores are minute, widely separated, one pair, on 5/6, on tiny tubercles.

The male pores are minute, each at the center of a small, oval, convex, smooth-surfaced tubercle. On the tubercles of the clitellate specimen there is a slight transverse central furrow. At the lateral margin of each tubercle is a thin fold of tissue that can be drawn mesially over the tubercle like an eyelid.

The genital markings are paired, on xvii, presetal, extending from the setae to 16/17, each marking elongate-oval to almost circular, slightly elevated, with smooth, flat surface, about 6-8 intersetal intervals wide, separated from the other marking by a midventral distance equal to 10-12 intersetal intervals. On the clitellate specimen there is an additional asymmetrical marking, presetal, on the right side of xvi.

*Internal anatomy.*—Septa 6/7-9/10 are all present and thickly muscular; 10/11-13/14 are strengthened but membranous.

The gizzard is in viii. There is a slight but lobed glandular collar on the esophagus in ix just behind 8/9. The intestine begins in xvi. The intestinal caeca are simple, long; the dorsal and ventral margins smooth.

In segment ix there is a pair of large, heartlike, blood-filled commissures, passing ventrally from the supraesophageals. In the same

segment there is also a heartlike commissure passing from the dorsal blood vessel to the ventral vessel. The commissures of *x* pass from the supraesophageals to the ventral trunk. In *viii* there is a pair of large vessels passing from the dorsal trunk to the gizzard, but no commissures to the ventral vessel were found. The last pair of hearts is in *xiii*.

The testis sacs of *x* and *xi* are unpaired and ventral. The seminal vesicles are small and lateral in position. The prostates are confined to *xviii*. The prostatic duct is about  $2\frac{1}{2}$  mm in length, bent into a sort of C-shape, the ectal half thicker than the ental half.

The spermathecae are large relative to the size of the worm in the clitellate specimen, obviously but partially developed in the aclitellate worm. The duct is long and slender, longer than the ampulla. The diverticulum is longer than the combined lengths of duct and ampulla and passes into the duct close to the parietes. The diverticulum comprises three regions: a slender, smooth, ectal portion, which has a very narrow lumen; a shorter but slightly wider middle portion that is bent into 2–3 very short loops and in which the lumen is slightly widened; and an ental, ovoidal, thin-walled, seminal chamber.

In the parietes dorsal to each genital marking is a whitish mass, that does not project into the coelomic cavity.

*Remarks.*—Neither of the specimens is in good condition; the aclitellate specimen is softened; the clitellate specimen very brittle—in spite of considerable care the worm broke into two pieces, the break slightly in front of the clitellar region.

Chen (1936, p. 273) places the gizzard in *ix* (presumably a typographical error) and the male pore (p. 272) *lateral* to the tubercle in the male pore invagination.

*P. timella* is distinguished from *P. zoysiae* Chen, 1933, by the presence and muscularity of septa 8/9–9/10 and by the presence of genital markings.

#### PHERETIMA MORRISI (Beddard)

- 1892 *Perichaeta morrisi* BEDDARD, Proc. Zool. Soc. London, 1892, p. 166 (type locality: Penang; type in the British Museum).
- 1896. *Perichaeta insulae* BEDDARD, Proc. Zool. Soc. London, 1896, p. 204 (type locality: Hongkong; type in the British Museum).
- 1912. *Pheretima browni* STEPHENSON, Rec. Indian Mus., vol. 7, p. 273 (part) (excluding quadrithecal forms with spermathecal pores on 7/8–8/9; Tengyueh, Yunnan).
- 1931. *Pheretima* (*Ph.*) *hawayana* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159 (part) (excluding sexthecal forms); Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 3 (part) (excluding sexthecal forms).
- 1931. *Pheretima* (*Ph.*) *morrisi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 148 (Szechwan).

1932. *Pheretima hawayana* GATES, Lingnan Sci. Journ., vol. 11, p. 512 (part) (excluding sexthecal forms).
1932. *Pheretima hawayana barbadensis* UDE, Archiv für Naturg., new ser., vol. 1, p. 155 (Foochow).
1933. *Pheretima morrissi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 267 (part) (excluding *P. browni* Gates, 1932, from the synonymy—there is no such reference; Chekiang).
1935. *Pheretima morrissi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 121 (Amoy); Bull. Fan Inst. Biol. Peiping, vol. 6, p. 33 (Hongkong).
1936. *Pheretima morrissi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 270 (Szechwan).

*Material examined*.—From the British Museum: 1 dissected clitellate specimen labeled "*Pheretima insulae*. 1904.10.5.86. Hongkong. Coll. Beddard"; 31 specimens from a tube labeled "*Pheretima barbadensis*. 1904.10.5.1219.1228. Hongkong. Coll. Beddard"; 3 specimens from a tube labeled "*Pheretima morrissi*. 1904.10.5.453. Hongkong. Coll. Beddard." From Dr. Graham: 1 clitellate specimen labeled "Suifu, 1,000–1,500 feet"; 2 clitellate specimens labeled "Near Yueh Shi, 6,000–8,000 feet, August 11, 1928"; 1 clitellate specimen labeled "Mupin, 3,500–5,000 feet, July 1, 1929"; 2 clitellate specimens labeled "South of Suifu, 1,200 feet, May 11, 1924"; 9 clitellate specimens labeled "At Lo-gu in the Ning-Yuen-fu prefecture, 6,500–8,000 feet, July 22–23, 1928"; 8 specimens labeled "Uingin-shien, 2,500–7,000 feet, July 14–15, 1928."

*Remarks*.—The first dorsal pore (Szechwan specimens only) is on 10/11 or 11/12 (but with a definitely porelike though apparently non-functional marking on 10/11).

The setal numbers and location of genital markings of 10 of the Szechwan specimens are as follows:

vi	xvii	xviii	xix	Preclitellar <sup>1</sup>		Postclitellar genital markings <sup>2</sup>
				Median genital markings	Lateral genital markings	
22	17	10	18	vi, vii	vii	xviii
25	17	14	21	vii, viii	vii	xviii-xix
23	23	13	20	vi, vii, viii	0	0
24	26	17	19	vii, viii	0	0
22	21	14	19	vi, vii	0	0
24	20	15	19	0	vii	0
23	18	15	19	0	vii	0
25	19	13	20	vii	0	0
21	19	15	18	vii	vii	0
24	19	15	21	0	0	0

<sup>1</sup> Median markings are unpaired, lateral markings are paired, all presetal.

<sup>2</sup> Excluding the usual pair of markings just median to the male pore tubercle.

## PHERETIMA OMEIMONTIS Chen

1931. *Pheretima* (Ph.) *paraglandularis* var. *omeimontis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 155 (type locality: Mount Omei, Szechwan; types in the Museum of the Science Society of China).
1935. *Pheretima omeimontis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 12.

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Suifu, September 1924."

*External characteristics*.—Length, 91 mm. Greatest diameter, 4 mm. The setae begin on ii, on which segment there is a complete circle. The setae are small, fairly closely crowded and regularly spaced. Setal formula: viii/23, xvii/17, xviii/12, xix/16.

The first dorsal pore is on 12/13.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows, dorsal pores, and setae lacking.

The spermathecal pores are minute, two pairs on 7/8–8/9, on tiny tubercles.

The male pores are minute, each pore at the center of a tiny tubercle, which in turn is at the center of a clearly marked, transversely oval area. After the prostatic duct was carefully pulled out from the parietes, the tubercle was removed, with a round aperture left at the center of the oval area.

The genital markings are small, circular, grayish, pore-bearing disks, on segments xi and xviii. The preclitellar markings are restricted to the anterior portion of the segment, arranged into a rectangular patch that is about 12 intersetal intervals wide transversely and that reaches from the setae to 10/11. There are 42 markings on the patch, in four transverse lines of about 10 each, though the lines are not exactly regular. Four or five disks form a semicircle at the median, anterior, and posterior margins of each oval, male pore area. Just anterior and slightly median to each semicircular row of disks there is a patch of four markings, probably on the anterior margin of xviii (17/18 not visible ventrally).

*Internal anatomy*.—Septa 5/6–7/8 are present, 6/7–7/8 slightly thickened; 8/9–9/10 absent; 10/11 and a few succeeding septa slightly thickened.

The intestine begins in xv. The intestinal caeca are compound, glove-shaped, with 4–7 secondary, anteriorly directed, fingerlike caeca; the dorsalmost secondary caecum the longest; the length of the caeca decreasing passing ventrally.

The last pair of hearts is in xiii.

The testis sacs of x and xi are ventral and unpaired. The seminal vesicles are fairly large, in contact transversely over the dorsal blood vessel. The prostates extend through segments xvii or

xviii-xxii. The prostatic duct, which extends through several segments, is elongate: the entalmost portion thin, whitish, with one small kink; the middle portion about 4 mm in length, thick, almost straight; the ectal portion thinner and curled or twisted.

The spermathecal duct is shorter than the ampulla and is narrowed in the parietes. The diverticulum is elongate and looped in a more or less zigzag fashion.

There are stalked glands in x anterior to 10/11 and in xviii. The stalks of these glands are slender but firm and longer than the stalks of somewhat similar glands in *P. hawayana* and *P. diffringens*.

*Remarks.*—The account above agrees, on the whole, with that given by Chen for his var. *omeimontis*. One of Chen's worms lacks the characteristic patch of genital markings on xi, but it does have genital markings in the region of the spermathecal pores. The variant specimen may be abnormal or possibly specifically distinct.

As has already been noted on a previous page, Fang's *P. paraglandularis* is a synonym of *P. aspergillum*. The Szechwan worms are clearly distinguished from *aspergillum* by the presence of a patch of closely crowded genital markings on xi. Var. *omeimontis* must accordingly be raised to the status of a species.

#### PHERETIMA PAETA Gates

1935. *Pheretima paeta* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 13 (type locality: Song Pan, Szechwan; types in the U. S. National Museum).

1936. *Pheretima paeta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol 11, p. 300 (after examination of types).

*Material examined.*—From Dr. Graham: 4 specimens labeled "Song Pan, mouth of the Yellow Dragon Gorge, July 26, 1924"; 1 specimen labeled "Yellow Dragon Gorge near Song Pan, 12,000-13,000 feet, July 25-26, 1924."

*External characteristics.*—Length, 75-136 mm. Diameter, 5-6 mm.

The setae begin on ii, on which segment there is a complete circle. The ventral setae of ii-ix are slightly enlarged. A midventral gap in the setal circles is lacking or very slight, a middorsal gap of variable width present. The setal numbers are as follows:

viii	xvii	xviii	xix	xx	First dorsal pore
22	19	16	21	-----	12/13
23	18	13	24	-----	12/13
22	21	13	22	-----	12/13
24	-----	14	-----	65	11/12
24	-----	10	-----	68	12/13

The first dorsal pore is on 11/12 or 12/13.

Two specimens have no clitellar glandularity at all; three specimens have slight traces of clitellar glandularity on xiv-xvi.

The secondary spermathecal apertures are two pairs on 7/8-8/9; the apertures wide slits that open into deep depressions. If the margins of a depression are separated, the minute primary spermathecal pore may be seen, with favorable illumination, at the center of a smooth, flat, circular to oval area on the roof of the depression.

On xviii on each side, on the least mature specimen, there is a rather deeply bowed, crescentic slit, with its concave margin directed midventrally. The slit opens into a parietal invagination, which is deepest laterally and rather shallow toward the median ends of the crescent. The lateral wall of the invagination is thin and lacks setae. On the median wall of the invagination is a ridge of tiny lobes or roughened projections, continuous with the circumferential ridge on which the setae are located, but no setae were found in or between the lobes. Median to the slit but between the anterior horn and the setae is a transversely oval, flat-surfaced, slightly protuberant tubercle. On another specimen the lateral portion of this presetal tubercle is within the parietal invagination (here deeper); before the whole of the tubercle can be seen the lateral lip must be cut or drawn aside. On the maturest specimen the presetal tubercle is entirely within the invagination (in reality in this worm a copulatory chamber) and not visible until the chamber is cut open. The aperture on this specimen is larger and nearly circular.

There may be a second tubercle on xviii, postsetal in position and in line with the presetal tubercle and of about the same size and appearance. On the dorsal roof of the invagination are 2 or 3 additional tubercles of varying shape and size, on one of which the minute male pore is located.

The preclitellar genital markings are symmetrically paired on vii and viii, on the posteriormost margins of the segment, almost on the intersegmental furrows, each marking 1-3 intersetal intervals median to the spermathecal pore. On the most nearly mature specimen these markings are slightly protuberant and may be called tubercles. On the other specimens the markings are scarcely visible, the boundary of each marking represented by a very slight furrow. Curiously, a porelike depression at the center of these markings is much more readily visible, as a rule, when the markings are only slightly developed.

*Internal anatomy.*—Septa 5/6-7/8 are slightly thickened; 8/9-9/10 lacking; 10/11-12/13 muscular.

The intestine begins in xv. The intestinal caeca are compound, with 3-11 anteriorly directed, secondary caeca, the dorsalmost the



longest. The dorsalmost caecum may have several tertiary caeca on its ventral margin, these usually ventrally directed. In one specimen these tertiary caeca are readily noticeable on each side, but the ventral secondary caeca are not visible from above (in the dorsal dissection) and were not noticed until the intestine was rolled well over to one side. It would be very easy to overlook ventral secondary caeca placed as were these.

The hearts of *x* are bound to the anterior face of 10/11 by connective tissue. The last pair of hearts is in *xiii*. All hearts of *x-xiii* pass into the ventral blood vessel.

The testis sacs are unpaired and ventral, one on the anterior face of 10/11 and the other on the anterior face of 11/12. The anterior margins of the sacs are bilobed; in *xi* the anterior ends of the lobes alone reach to 10/11. The seminal vesicles of *xi* and *xii* are large and in contact transversely over the dorsal blood vessel. In *xiii* there is a pair of small, stalked pseudovesicles, the head ovoidal or flattened anteroposteriorly into an oval disk. In *xiv* there is a pair of smaller pseudovesicles, the head rounded or flattened and lobed or crenulated. The prostates extend through *xvii-xix* or *xx*. The prostatic duct is 3-6 mm in length, bent into a U- or C-shape, the ectal portion thickened. In the maturest specimen there are large copulatory chambers projecting conspicuously into the coelomic cavity. In the other three specimens there is no trace of a copulatory chamber projecting into *xviii*, the male pore invagination entirely confined at this stage to the parietes.

The spermathecae are obviously juvenile even in the maturest specimen. Careful removal of the longitudinal musculature shows the spermathecal duct (?) passing through the parietes without any decrease in diameter but on the contrary in at least one specimen a slight increase in thickness. The ectal end of this thick duct contains the invagination within which is the true spermathecal pore. Pulling the duct out from the parietes leaves an unusually wide transverse slit on the intersegmental furrow. The diverticulum comprises an ectal, smooth, thick-walled but slender stalk and a thinner-walled, sometimes slightly wider, elongate seminal chamber that is bent back and forth in a zigzag fashion, the limbs of the loops approximated and usually all in the same plane.

Just median to the prostatic duct are two glandular masses projecting slightly into the coelomic cavity. In one specimen minute stalked glands were found among the longitudinal muscle fibers in the region of the preclitellar genital markings.

*Remarks.*—The most nearly mature specimen is broken, the surface of the anterior segments damaged in places by gravel. Another specimen is softened. With full maturity the spermathecal

pore invaginations may be deepened, possibly but not probably developing into spermathecal chambers. The development of the copulatory chamber from a parietal invagination like that characteristic of certain species, such as *P. tschiliensis* Michaelsen, 1928, is noteworthy.

*P. paeta* is distinguished from *P. omeimontis* by the copulatory chambers and even in young aclitellate specimens by the parietal male pore invaginations. From *P. schmardae* (Horst, 1883) *P. paeta* is distinguished by the invaginate spermathecal pores, the median location of the copulatory chamber glands, and the presence of pre-clitellar genital markings. A satisfactory diagnosis of *P. paeta* cannot, of course, be given until fully clitellate specimens have been available for study.

#### PHERETIMA PAPILLIFERA Gates

1935. *Pheretima papillifera* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 13

(type locality: Yachow, Szechwan; type in the U. S. National Museum).

1936. *Pheretima papillifera* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 300 (after examination of type).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Near Yachow."

*External characteristics*.—Length, about 100 mm. Diameter, 4 mm.

Setae begin only on iv, on which segment there are but a few scattered ventral setae. There are middorsal gaps of varying width in the setal circles and a fairly regular but slight midventral gap. The setae are small and closely crowded, but with frequent asetal gaps. Setal formula: vi/11 +, vii/13 +, xvii/8 +, xviii/10, xix/10, xx/ca. 41 (+ denotes asetal gaps).

The first dorsal pore is on 11/12.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows and dorsal pores lacking; no setae visible.

The spermathecal apertures are minute, widely separated, three pairs, on 5/6–7/8.

The male pores are minute. On the left side the male pore is at the center of a circular, smooth area, which is demarcated by a slight furrow. No definite male pore area can be discovered on the right side.

The genital markings are circular, about 1–1½ intersetal intervals wide, presetal, fairly closely paired, one pair on each of segments xi–xiv. The last pair are in contact with the whitened, transversely oval area on which the female pore is located.

*Internal anatomy*.—Septa 5/6–7/8 and 10/11–12/13 are thickly muscular; 8/9–9/10 lacking.

The intestine begins in xv. The intestinal caeca are long, slender, and simple, dorsal and ventral margins practically smooth.

There is a single heart belonging to ix, on the right side. The hearts of x are bound to the anterior face of 10/11 by connective tissue. The last pair of hearts is in xiii. All hearts of ix-xiii pass into the ventral vessel.

There are two testis sacs on the anterior face of 10/11, the sacs completely separated from each other and without transverse communication. There is also a pair of testis sacs in xi without transverse communication. The seminal vesicles are either attached to the dorsal surfaces of these testis sacs or are contained within the sacs. The prostates extend through xvii-xix. The prostatic duct is about  $5\frac{1}{2}$  mm in length and variously twisted.

The spermathecal duct, which is abruptly narrowed deep in the parietes, is stoutish, firm, and glistening, as long as or slightly shorter than the ampulla. The diverticulum passes into the anterior face of the duct in the parietes, is shorter than the combined lengths of duct and ampulla, and comprises a very short, firm, smooth, glistening stalk portion and a slightly wider, more irregular, ental portion.

There are no glandular masses in the parietes in the region of the spermathecal ducts and the prostatic ducts. There is a glandular mass sessile on the parietes over each genital marking.

*Remarks.*—The condition of the right male pore region and the distribution of the setae indicate that the specimen is abnormal.

The type locality is Yachow, according to Dr. Graham (*in litt.*), not "Zachoo" as previously spelled (Gates, 1935, p. 13).

*P. papillifera* is distinguished from *P. abdita* by the superficial male pores, from *P. tuberculata* Gates, 1935, by the simple intestinal caeca, and from *P. hawayana* by the genital markings on xi-xiv.

#### PHERETIMA PECTENIFERA Michaelsen

1931. *Pheretima* (Ph.) *pingi* (part) + *P.* (ph.) *pectenifera* (in part only?)  
MICHAELSEN, Peking Nat. Hist. Bull. vol. 5, pt. 3, pp. 2, 11 (type locality of *pectenifera*: Soochow; types in the Hamburg Museum); Zool. Jahrb. (Abt. Syst.), vol. 61, pp. 561, 564.

1933. *Pheretima yamadai* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 255 (part) (excluding "A" forms at least, and from synonymy *P. yamadai*).

1935. *Pheretima pectenifera* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 13.

1936. *Pheretima yamadai* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 255.

*Material examined.*—From the Hamburg Museum: 3 clitellate specimens from a tube labeled "*Pheretima* (Ph.) *pectenifera* Mich.

Originale. Soochow. Biol. Station leg."; 4 specimens from a tube labeled "*Pheretima (Ph.) pingi* Steph. Soochow. Biol. Station leg."

*External characteristics*.—Length, to 220 mm. Diameter, to 10 mm.

The setae begin on ii, on which segment there is a complete circle. The setal circles are unbroken midventrally; a slight middorsal break may be present. Setal formulae of 7 specimens are as follows, the first four from the tube labeled *P. pingi*:

vii	viii	xvii	xviii	xix	xx
30	32	32	34	29	78
27	29	25	30	26	82
27	29	26	26	24	-----
28	29	27	29	25	-----
29	29	28	30	27	76
31	31	38	39	28	-----
39	36	29	36	33	97

The first dorsal pore is on 12/13 (7 specimens).

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores, intersegmental furrows, and setae lacking.

The spermathecal pores are minute, widely separated; three pairs, on 6/7–8/9.

Each minute male pore is located at the center of an area of grayish translucent appearance. The area is rather small and approximates to elongate-oval in outline. The whole of the male pore area may be visible on the ventral face of a male porophore, with a slight suggestion of a lip just lateral to the area, or the area may be slightly sunk and the lip more evident or the area may be more deeply sunk in the parietes and invisible from the exterior, completely covered over by a lateral lip. On each male pore area there are four tiny circular markings, anterior, posterior, lateral, and median to the male pore. The anterior and posterior markings are slightly larger than the other two. The margins of the markings are rather definite but can be recognized as such only with brilliant illumination and high magnification.

The male porophores are broad low protuberances approximating to circular in outline and extending across xviii and slightly onto xvii and xix. The ventral face of a porophore may be rather flat or a lateral portion on which the male pore area is located may be especially protuberant. On the ventral face of the porophore median to the male pore area are four sharply defined, circular, grayish-translucent genital markings, each of which is larger than the markings on the male pore area.

These markings are not in contact and usually are so placed as to form four corners of a square, with two of the markings presetal and two postsetal. This arrangement is, apparently, quite characteristic, as the only variation on any of the seven worms is the absence of the median presetal marking of one or both sides. The male setae of xviii are continued onto the porophore nearly to the male pore area, but on the ventral face of the porophore they are smaller and more closely crowded than midventrally. The setae in the region between the two pairs of genital markings, on some specimens, are so closely crowded as to be forced anteriorly or posteriorly out of line in such a way as to produce a zigzag appearance. A similar zigzagging of a setal row is apparent on two specimens, on xvii on each side just anterior to the male porophore.

The male porophores certainly represent an everted condition of some sort of a male pore invagination. In a carefully dissected specimen the porophore can be retracted at least partially. If, in a completely retracted condition, there is a true copulatory chamber, then the four genital markings and the small closely crowded setae will probably be withdrawn into the interior of the chamber. A lateral lip similar to that which can be seen on those specimens with slightly retracted male pore areas is, however, usually associated with a deep parietal invagination, which does not reach through the body wall into the coelomic cavity. If the male pore invagination in *P. pectenifera* is a parietal invagination of this sort, then in a retracted condition the four genital markings and the small closely crowded setae may be invisible from the exterior.

Aside from the markings on the ventral face of the male porophore there are no postclitellar genital markings. The preclitellar genital markings are of two sizes. The smaller markings are on the posteriormost margins of vi-viii in close proximity to the spermathecal pores. There are usually three of these markings, one immediately anterior to, one immediately lateral to, and one immediately median to each spermathecal pore, but both the lateral and median markings may be lacking or only the anterior marking. These markings and the spot on which the spermathecal pore is located are of a grayish translucence and so closely crowded together that identification of the spermathecal pore and of the margins of the markings is difficult.

The larger, paired markings are presetal on vii, viii, and ix and postsetal on vii and viii; each marking in 5-8 intersetal intervals median to the spermathecal pore and usually slightly nearer to the setae than to the intersegmental furrow. One marking of a pair may be lacking, or an additional marking may be present close to one of the usual markings. The presetal markings of ix are lacking

on 5 specimens; the presetal markings of vii lacking on 2 specimens; the postsetal markings of viii lacking on 1 specimen. Each marking is circular, about 1 intersetal interval in diameter, of a grayish translucence, delimited by a slight circumferential furrow and with a peripheral rim portion slightly elevated.

*Internal anatomy.*—Septa 5/6–7/8 are thickened; 10/11 strengthened but translucent; 11/12–13/14 slightly strengthened; 8/9–9/10 lacking.

The intestine begins in xv (4 specimens). The intestinal caeca are compound, glove-shaped. Each caecum is composed of 5–7 elongate and fingerlike secondary caeca. The dorsalmost secondary caecum is usually longer than the other secondary caeca, but in one specimen all the secondary caeca are of about the same length. The secondary caeca usually have smooth dorsal and ventral margins, but there may be one or two short but definitely fingerlike tertiary caeca on the ventral margin of any particular secondary caecum. The typhlosole begins just behind the caeca.

There is a pair of hearts belonging to ix in one specimen; a single heart belonging to ix in three specimens, on the right side (1 specimen) or the left side (2 specimens). The last pair of hearts is in xiii (4 specimens). The hearts of x are filled with blood and readily recognizable. All hearts of ix–xiii pass into the ventral blood vessel.

The testis sacs are unpaired and ventral. The seminal vesicles of xi and xii are fairly large and are in contact transversely above the dorsal blood vessel. Each vesicle has a well-developed primary ampulla, conical to pyramidal in shape, the base of which is sunk into the dorsal margin of the ventral lamina. The ampulla is deeply constricted off from the ventral lamina, in one specimen the two portions of the vesicle connected only by a slender cord. The prostates extend through some or all of segments xvi–xxii. The prostatic duct is 8–10 mm in length, bent into a hairpin loop, the ectal limb much thicker than the ental limb.

On the parietes just median to the ectal end of the prostatic duct there are two transversely ovoidal masses of softish, glandular tissue. Each of these masses can be separated, when all genital markings are present, into two distinct masses, each with its own duct passing into the body wall. Within or on the parietes but closer to the prostatic duct are four smaller and more nearly spheroidal glandular masses, the stalks or ducts of which pass to the four genital markings on the male pore area.

The spermathecal duct is muscular, with a smooth, glistening, pinkish appearance, the length equal to or less than that of the ampulla. The diverticulum passes into the median face of the duct

close to the parietes; ectal to this junction the duct much narrowed. The diverticular stalk is very short, always shorter than the spermathecal duct and like the duct is smooth, glistening, and muscular. The seminal chamber is long and thin walled; the chamber may be almost straight, bent, twisted, or with one or two very short loops, the limbs of the loops in apposition.

A glandular mass projects from the parietes into the coelomic cavity in front of each spermatheca. The glandular mass comprises one, two, or three distinct glands, according to the number of genital markings in close proximity to the spermathecal pore. A short ental portion of the gland duct of the larger preclitellar, genital markings is coelomic, lifting the gland into the coelomic cavity slightly above the parietes.

*Remarks.*—In the translation of the description of *pectenifera*, Dr. Boring (Michaelsen, 1931) has made several mistakes. On page 16 the statement regarding intestinal caeca should read, "The size of the caeca *decreases* regularly from above downwards" i. e., passing ventrally. Further corrections: The seminal vesicles of xi are *not* grown together above the intestine; the seminal vesicles of xii are *not* fused ventrally; the testis sac of xi does *not* "extend over" the anterior testis sac but over the anterior seminal vesicles.

The three types of *P. pectenifera* are all characterized by minute spermathecal pores. According to Michaelsen the spermathecal pores are "ziemlich grosse Querspalte." The size of spermathecal pores is not subject intraspecifically to such extremes of variation as this would appear to indicate. Either Michaelsen is mistaken with regard to the size of the spermathecal pores or else the original material comprises two specifically distinct forms (one with large spermathecal pores or minute but invaginate pores communicating with the exterior by large secondary openings).

Furthermore, the testis sacs in the three types are ventral, but according to Michaelsen the posterior sac is (Michaelsen considers the single sac to be in reality a pair of sacs "in ganzer Breite miteinander verschmolzene") "nicht geschlossen" that extends over, "übergehen," the seminal vesicles of xi. What the author means by an "open" testis sac (in *Pheretima* the sacs are always closed) that "passes over" the seminal vesicles is not clear unless the anterior vesicles are included within the posterior testis sac. But the vesicles of xi of the types examined are not so included. Possibly the type series of *pectenifera* comprises two species, one with included and one with excluded seminal vesicles.

The male pore region of *P. pectenifera* is so remarkably like that figured for *P. yamadai* Hatai, 1930, that the former may be, in reality, a synonym of the latter. Hatai's species is not, however, ade-

quately characterized, and inasmuch as types or specimens of *P. yamadai* have not been available for examination Michaelsen's species is retained. If Michaelsen's species is in fact composite and actually in part a synonym of *yamadai*, the name *pectenifera* will have to be retained for the remaining part.

**PHERETIMA PINGI** Stephenson

1925. *Pheretima pingi* STEPHENSON, Proc. Zool. Soc. London, 1925, p. 891 (type locality: Nanking; type in the British Museum).  
 1931. *Pheretima pingi* MICHAELSEN, Lingnan Sci. Journ., vol. 8, p. 159.  
 1931. *Pheretima pingi* STEPHENSON, Proc. Zool. Soc. London, 1931, p. 55.  
 1931. *Pheretima* (*Ph.*) *pingi* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 2, 11 (part); Zool. Jahrb. (Abt. Syst.), vol. 61, p. 56 (part) (Nanking; specimens in the Hamburg Museum).  
 1933. *Pheretima pingi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 228 (part only?) (excluding forms with no spermathecae in v ?).  
 1934. *Pheretima kyamikia* KOBAYASHI, Journ. Chosen Nat. Hist. Soc., vol. 19, p. 1 (type locality: Korea; types ?).  
 1935. *Pheretima pingi* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 14.  
 1936. *Pheretima carnosa* KOBAYASHI, Sci. Rep. Tohoku Univ., ser. 4, vol. 11, p. 115 (part), excluding from synonymy *hawayana* Gates, 1932).

*Material examined*.—From the British Museum: 1 specimen labeled "*Pheretima pingi* Stephenson. Holotype. 1924.11.29.5. Nanking, China"; From S. Kobayashi: 1 clitellate specimen labeled "*Ph. kyamikia* Kobayashi (Tetsugen) Kogen-do" (this specimen is unusually well preserved). From the U. S. National Museum: 18 specimens labeled "Kiangsu, Nanking. National Southeastern University by C. Ping." From Dr. Graham: 1 clitellate specimen labeled "Near Mupin, 7,000–13,000 feet, July 8, 1929."

*External characteristics*.—Length, 120–190 mm. Diameter, 5–7½ mm.

The setae begin on ii, on which segment there is a complete circle. The setae of ii–viii or ix are enlarged, especially ventrally. From viii or ix, passing posteriorly, the size of the setae decreases, the setae of xvii larger than those of xix but smaller than those of xi; the setae of the posteriormost segments slightly larger than those in segments of the middle of the body. The setal numbers are indicated as follows:



vi	vii	viii	xvii	xviii	xix	xx	First dorsal pore
14	15	18	(17-24)	22	(19-26)	(57-64)	12/13
16	16	20		19			12/13
14	16	18		20			12/13
13	14	17		20			12/13
16	16	20		21			12/13
16	18	21		16			11/12
13	14	16		19			11/12
14	14	17		18			11/12
11	11	14	26	15	26	66	<sup>1</sup> 12/13
-----	-----	-----		20			<sup>2</sup> 12/13

<sup>1</sup> From Mupin.

<sup>2</sup> Kobayashi's specimen (33/iii, 40/vi, 46/viii, 62/xii).

The first dorsal pore is on 11/12 (3 specimens), 12/13 (14 specimens), or 13/14 but with a definitely porelike marking on 12/13 (3 specimens).

The clitellum is annular, extending from 13/14-16/17; intersegmental furrows and functional dorsal pores lacking though porelike markings are sometimes present; a few scattered setae present ventrally on some or all of segments xiv-xvi.

The spermathecal pores are minute, widely separated, on tiny tubercles; four pairs, on v-viii, just anterior to the intersegmental furrows, the latter clearly visible just behind the pores.

Each minute male pore is located at the center of a circular, smooth, glistening disk, which is marked off by a slight but definite circumferential furrow. A male pore disk may be at the general epidermal level, slightly depressed *in toto* or folded and depressed at the fold. In the latter case there is rather superficial resemblance to the transversely slitlike opening of a copulatory chamber. The disks of Kobayashi's specimen are 3 intersetal intervals wide transversely.

The genital markings are circular to transversely oval or thickly crescent-shaped. The latter are postsetal protuberances (often smooth and glistening) on the posterior margins of v-viii, so placed that the tiny spermathecal pore tubercle is within the concave posterior margin of the crescent. Other genital markings are not so close to the intersegmental furrows; 1½-4 intersetal intervals wide transversely, with a more or less easily recognizable, thick, cream-colored rim and a grayish or brownish, translucent, central portion that may be flat, concave, or convex. The markings are symmetrically paired, presetal on viii, ix, xviii, and xix and postsetal on xviii. On 10 specimens the markings are located as follows:

Segment	Location	Specimens
viii	Each marking just lateral to the midventral line.....	2
viii	Each marking just median to the spermathecal pore line.....	4
ix	Each marking just lateral to the midventral line.....	4
ix	Each marking just median to the spermathecal pore line.....	6
xviii	Each presetal marking immediately median to the male pore disk.....	4
xviii	Each presetal marking just lateral to the midventral line.....	3
xviii	Each postsetal marking median to the male pore disk but not as close to the disk as a lateral, presetal marking.	10
xix	Each presetal marking in line with or about in line with the postsetal marking of xviii.	5

Of the remaining nine (U. S. N. M.) specimens five have symmetrically paired markings on the locations indicated above. Four worms lack one of a pair of markings. Of these last, two have one or two unpaired, median, presetal markings, one on viii, or one each on viii and ix. On Kobayashi's specimen, in addition to the crescentic, postsetal markings just in front of the spermathecal pores, there is a presetal marking in *cd* on each side of viii and ix, a presetal marking in *cd* on each side of xviii, and a postsetal marking in *j/k* on xviii on each side.

*Internal anatomy.*—Septa 5/6–7/8 are thickly muscular; 8/9 complete but thin, pushed posteriorly into a funnel-shape by the gizzard; 9/10 lacking; 10/11–12/13 thickly muscular; 13/14 slightly muscular.

The intestine begins in xv, but when the gut is empty that portion of the intestine anterior to 15/16 may be invaginated posteriorly into the gut lumen of xvi, so that the intestine appears to begin in xvi or with 15/16. If the gut in xvi is carefully opened the invaginated portion can be pushed anteriorly into xv so that the origin in xv is clearly recognizable. The intestinal caeca are simple: the dorsal and ventral margins smooth or constricted slightly by the septa through which the caeca pass, occasionally the ventral margin provided with a few slight additional incisions.

One or both hearts of ix may be present. In either case the heart or hearts are posterior to the first postgizzard septum, which must therefore be 8/9. The hearts of x are present but are small and not easy to find when empty, as they are bound to 10/11 by connective tissue. In Kobayashi's specimen the left heart of x is filled with blood and is as large as the heart (left) of ix. The right heart of x is small and empty. The last pair of hearts is in xiii. All hearts of ix–xiii pass into the ventral trunk. (Hearts of x were not found in the type.)

The lymph glands in xv–xxvi are elongate, finger-shaped; from xxviii posteriorly they are flattened, leaflike bodies, often bilobed or trilobed.

The testis sacs of *x* and *xi* are unpaired and ventral. The seminal vesicles of *xi* and *xii* are in contact transversely over the dorsal blood vessel. Each vesicle has a rounded, primary ampulla, with a smooth or finely granular surface. The lateral face of the ventral lamina of each vesicle has a convoluted appearance. When the delicate transparent sheath surrounding the ventral lamina of a vesicle is removed, the contents separate into columnar blocks. These blocks are so placed within a vesicle that the long axes are mesiolateral. The prostates extend through some or all of segments *xvi-xx*. The prostatic duct is 5-8 mm long, usually bent into an elongate, hairpin-shaped loop, the ectal limb of the loop slightly thicker than the ental limb.

The spermathecal duct is smooth and slender, about as long as or slightly shorter than the ampulla; narrowed gradually in the parietes. The diverticulum is not so long as the combined lengths of duct and ampulla and passes into the anterior face of the duct close to the parietes. The smooth, slender stalk is 2-3 times the length of the seminal chamber, which may or may not be sharply marked off from the stalk. In Kobayashi's specimen the chamber is but slightly shorter than the stalk but  $1\frac{1}{2}$  times as thick. In each of several spermathecae there is a single very short loop in the diverticular stalk just ectal to the seminal chamber.

The glandular masses dorsal to the genital markings appear to be sessile on the parietes. The glands over the circular to oval markings are rather disklike; the postclitellar glands not so flat and more conspicuously protuberant into the coelomic cavity than the preclitellar glands.

The glandular material of the spermathecal pore markings is usually in the form of a "half-collar" in the parietes on the anterior face of the spermathecal duct. In this collar there can be seen a number of very fine stalks or ducts, which pass onto the anterior face of the spermathecal duct to which they are firmly attached. Occasionally and especially anterior to the spermathecae of *vi* and *vii* the glandular material is not aggregated into a half-collar but is represented by small bits of softish material between the longitudinal muscle bundles.

*Remarks.*—The "externally projecting chambers" present on the spermathecal ducts of the type are lacking in all but two of the specimens examined. In one of the exceptional specimens there are vesicular bodies on the duct of each spermatheca. In the second specimen only a few of the spermathecae are so characterized. These saclike or vesicular protuberances are thus not characteristic of the species. Quite possibly the vesicular outgrowths are the result of parasitic activity.

*P. pingi* is close to *P. diffringens*, from which it is distinguished by the slightly larger setal numbers, the larger number of male setae on xvii-xix, the posterior location of the first dorsal pore, the segmental and postsetal location of the spermathecal pores, the presence of postclitellar genital markings, presence of a complete septum 8/9, and presence of the hearts of x. The segmental location of the spermathecal pores is not obvious unless the specimens are well preserved.

Kobayashi (1936) places *pingi* in the synonymy of *carnosa* as a result of his examination of two octothecal Japanese specimens (from Morioka) with spermathecal pores on 5/6-8/9 that were labeled "*P. carnosus*." Unfortunately no history is given of these specimens of *carnosa*, and there is no valid reason for accepting Kobayashi's synonymy at present. The types of *carnosa* are from Tokyo and are sexthecal, with spermathecal pores on 5/6-7/8. Although Kobayashi claims to have had sexthecal specimens of *pingi*, the spermathecal pores on both of these specimens are on 6/7-8/9.

Kobayashi (both in 1934 and 1936) considers the spermathecal pores to be large. The pores are, however, at least on the specimen just examined, minute and superficial. Large spermathecal pores would have to be considered evidence for recognition as a distinctly different species.

#### PHERETIMA POMELLA Gates

1935. *Pheretima pomella* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 14 (type locality: Suifu, Szechwan; types in the U. S. National Museum).  
 1936. *Pheretima pomella* CHEN, Contr. Biol. Sci. Soc. China, zool. ser., vol. 11, p. 301 (after examination of type).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Suifu, 1,200-2,000 feet, October 1-November 1, 1938."

*External characteristics*.—Length, 87 mm. Diameter, 5 mm.

Setae are present ventrally on segment ii but are lacking dorsally; the dorsal gap narrows gradually on iii-v. On the postclitellar segments the middorsal gaps are variable in width. There is a definite but slight midventral gap from segment xxi posteriorly. Setal numbers: vii/19, xvii/19, xviii/14, xix/19, xx/ca. 50.

The first dorsal pore is on 10/11.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows, dorsal pores, and setae lacking.

The spermathecal pores are minute, on tiny glistening tubercles; presetal on vii and viii, slightly nearer to the intersegmental furrows than to the setae.

The male pores are minute, each pore at the center of a very short, slightly depressed, transverse area; the margins of the areas not definitely demarcated or demarcations unrecognizable because of the slight depression.

Immediately anterior and just posterior to each male pore is a transversely oval genital marking, about 1 intersetal interval wide, with a thick whitish rim and a grayish depressed center. Just in front of each anterior marking and just behind each posterior marking is a raised, transversely oval, whitish (glandular ?) patch. The centers of these patches are very slightly median to the centers of the genital markings. The centers of the genital markings are about in line with the male pores. There are two pairs of preclitellar genital markings, presetal on xii and xiii. These markings are round to transversely oval, about 2 intersetal intervals wide transversely, the markings of a pair separated by a midventral distance slightly greater than *aa*. Each marking has a flat grayish center, which is wider than the central portion of a postclitellar marking, and a whitish rim. The markings are slightly nearer to the setae than to the intersegmental furrows.

*Internal anatomy.*—No septa are thickly muscular; 8/9–9/10 lacking.

The intestine begins in xvi. The intestinal caeca are simple, constricted slightly by the septa through which they pass.

The last pair of hearts is in xiii. All hearts of ix–xiii pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral. The anterior margins of both sacs are bilobed. The seminal vesicles of xi and xii are fairly large, in contact transversely above the dorsal blood vessel. The prostates are confined to xvii–xviii. The prostatic ducts are about 3 mm long, of nearly the same thickness throughout, bent into a C- or a U-shape.

The spermathecal duct is shorter than the ampulla and is narrowed within the parietes. The diverticulum passes into the duct close to the parietes and comprises a short, slender stalk and a thicker, longer seminal chamber that is twisted into a mass of loops. There are masses of iridescent material (spermatozoa) in the seminal chambers.

*Remarks.*—There are cystlike bodies on the spermathecal seminal chambers, probably abnormal. Possibly some of the supposedly specific characters of this worm are also abnormalities.

*P. pomella* is distinguished from *P. planata* Gates, 1926, by the more posterior location of the spermathecal pores, the posterior location of the preclitellar genital markings, the absence of copulatory chambers, and the ventral testis sacs.

**PHERETIMA PRAEPINGUIS Gates**

1935. *Pheretima praepinguis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 15 (type locality: Mount Omei, Szechwan; type in the U. S. National Museum).
1936. *Pheretima praepinguis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 302 (after examination of type).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Mt. Omei, 4,400 feet."

*External characteristics*.—Length, 207 mm; a posterior portion probably lacking. Diameter, 16 mm.

The setae begin on ii, on which segment there is a complete circle. There is no definite midventral gap in the setal circles; the middorsal gaps of variable width. Setal numbers: vii/23, viii/24, xvii/20, xviii/9(+4?), xix/22, xx/93.

The first dorsal pore is on 12/13.

The clitellum is annular and extends from 13/14 to 16/17; only very slight traces of intersegmental furrows and dorsal pores visible: circles of setal pits present on xiv–xvi but no setae visible.

The secondary spermathecal apertures are transverse slits; three pairs on 6/7–8/9; the margins of the pores finely wrinkled.

The apertures of the male parietal invaginations are rather crescentic, but the left aperture gapes open so widely that some of the structures within the invagination are visible from the exterior. The invaginations are deep but confined to the body wall; the lateral wall of the invagination thin, lacking setae. The ventral margin of the thin lateral wall forms a rather crescentic lip at the lateral side of the aperture into the invagination. The minute male pore is on the ventral face of a smooth, glistening, protuberant tubercle, which is located dorsally in the lateralmost portion of the invagination. The median wall of the invagination is raised into a slight ridge on which is located a single circular tubercle, the latter near to but not in contact with the male pore tubercle. At the center on the ventral face of the tubercle several grayish porelike markings are visible. On the median wall of the invagination near the aperture and anterior to the ridge is a transversely oval genital marking, with a grayish, translucent, central portion and a raised opaque rim. The presetal marking is about three times the size of the tubercle on the ridge.

The external genital markings are presetal; three pairs, on vii–ix. Each marking is transversely oval, circular or longitudinally oval, located on the anterior margin of the segment just median to the secondary spermathecal pore. The markings are not sharply demarcated, but a central portion of a grayish, translucent appearance and a slightly protuberant, opaque rim can be distinguished.

*Internal anatomy.*—Septa 5/6–7/8 are thickly muscular; 8/9–9/10 lacking; 10/11–12/13 thickly muscular; 13/14 muscular.

On the esophagus immediately behind the gizzard there is a conspicuous, lobed, glandular collar. The intestine begins in xv on the right side, in xvi on the left side. The intestinal caeca are simple.

The single commissure of ix is on the left side. The last pair of hearts is in xiii. All hearts of ix–xiii pass into the ventral blood vessel.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles of xi and xii are vertical bodies reaching into contact with the dorsal blood vessel. Each vesicle is provided with a rather conelike, very smooth, primary ampulla, which is sunk into the dorsal margin of the ventral lamina. There are paired pseudo-vesicles in xiii and xiv. The prostates are relatively rather small; the right prostate confined to xviii though 17/18 and 18/19 are dislocated anteriorly or posteriorly; a small lobe of the left prostate extending into xvii. The prostatic duct is about 12 mm long, bent into a hairpin-shaped loop, the ectal limb of the loop thicker than the ental.

The spermathecal ampulla is about as long as or slightly longer than the duct. The latter is stoutish and with a rather bulbous appearance as it passes into the parietes. Within the body wall the duct is very abruptly and very considerably narrowed; the very short, slender portion of the duct opening to the exterior by a minute pore on the ventral face of a tiny, smooth, rather conical tubercle on the roof of the spermathecal invagination. The spermathecal invagination, transversely slitlike in section, is confined to the outer half of the rather thick body wall. On the anterior face of the spermathecal duct, close to the parietes is a spheroidal, glandular mass. A bundle of stalks or ducts from this gland passes through the parietes on the anterior face of the spermathecal duct to a circular genital marking located on the anterior wall of the spermathecal invagination. The junction of the diverticular stalk with the spermathecal duct close to the parietes is concealed from view by the anterior gland. The diverticulum comprises a smooth, glistening stalk and a much wider seminal chamber, the latter with two or three slight constrictions.

Just median to each prostatic duct a glandular mass projects conspicuously into the coelomic cavity. This mass is elongate, sausage-shaped, but this is not at first obvious, for a portion of the gland passes in an anteroventral diagonal fashion deep into the parietes. From the ventral face of this mass numerous cords or ducts pass posteriorly within the longitudinal musculature.

*Remarks.*—Stalked glands or glandular masses in connection with the presetal genital markings were not found.

No setae were observed on the median wall of the male parietal invagination but unusually small or very deeply retracted setae may have been overlooked.

*P. praepinguis* is close to *P. tschiliensis* from which it may be distinguished at present by the location of the primary spermathecal pores in parietal invaginations.

Chen (1936, p. 302) maintains that *praepinguis* is a synonym of *tschiliensis* and that the type of the former is not only "perfectly identical" with some of Chen's earlier specimens from Szechwan but also with the types of *grahami*. *P. grahami* is quite clearly distinguished from *praepinguis* by the unusual spermathecal chambers and the presence of copulatory chambers. What Chen's earlier specimens from Szechwan actually are cannot be determined from his description. *P. praepinguis* is, as was stated above, close to *tschiliensis* and, of course, cannot be satisfactorily characterized from a single specimen. The spermathecal pores of one species are superficial but in the other species are within definite, or what appear to be definite, parietal invaginations with large transversely slitlike apertures, which would normally be shut so as to conceal the primary pore from sight externally. Such an invagination appears to be of sufficient importance to distinguish *praepinguis* from *tschiliensis*, in view of the lack of intraspecific variation with regard to the spermathecal pore. If the two forms are really specifically distinct, examination of additional specimens of each should disclose further distinguishing characteristics.

#### PHERETIMA ROBUSTA (E. Perrier)

1872. *Perichaeta robusta* E. PERRIER, Nouv. Arch. Mus. Hist. Nat. Paris, vol. 8, p. 112 (no type designation; types from Mauritius and Manila in the Paris Museum).
1899. *Amyntas lohri* MICHAELSEN, Mitt. Naturhist. Hamburg, vol. 16, p. 12 (type locality: Shi-hui-yao near Wuchang, Hupei; types in the Hamburg Museum).
1931. *Pheretima siemsseni* (part) + *P. fokiensis* + *P. robusta* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 61, pp. 571, 574, 577 (type locality of *siemsseni*: Foochow; of *fokiensis*: Fukien Province; types in the Hamburg Museum).
1931. *Pheretima* (*Ph.*) *hesperidum* (part, excluding all except *lohri*) + *P. siemsseni* (part) + *P. fokiensis* + *P. robusta* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 2, 17, 19, 21.
1931. *Pheretima* (*Ph.*) *corrugata* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 131 (type locality: Kia-ting, Szechwan; types in the Museum of the Science Society of China).
1932. *Pheretima* (*Pheretima*) *lauti* UDE, Archiv für Naturg., new ser., vol. 1, p. 153 (Foochow; specimen in the Hamburg Museum).



1933. *Pheretima corrugata* + *P. lauta* (part only) CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, pp. 278, 282 [excluding from the synonymy of *lauta* the following: *lauta* Ude, 1905; *siemsseni* (part)]. (Chen distinguished two forms, coast and inland, part of which may have to be excluded.)
1935. *Pheretima robusta* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 15.
1935. *Pheretima robusta* + *P. ultoria* CHEN, Bull. Fan Inst. Biol. Peiping, vol. 6, pp. 36, 42 (type locality of *ultoria*: Hongkong; types in the Museum of the Fan Memorial Institute of Biology).
1936. *Pheretima robusta* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 271.
1937. *Pheretima masatacae* KOBAYASHI, Sci. Rep. Tohoku Univ., ser. 4, vol. 11, p. 337.

THE FOLLOWING DOUBTFULLY PLACED IN SYNONYMY:

1933. *Pheretima corrugata* var. *kulingiana* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 278 (type locality: Kiukiang, Kiangsi; types in the Museum of Zoology of Central University, Nanking).
1935. *Pheretima robusta* GATES, Lingnan Sci. Journ., vol. 14, p. 453 (after examination of a topotype of var. *kulingiana*).
1935. *Pheretima aspergillum* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 120 (Amoy).

*Material examined*.—From the Hamburg Museum: 1 clitellate specimen (A) labeled "V 7356. *Pheretima robusta* (E. Perr.). China, Futschau. Consul Siemssen 1/d"; 1 clitellate specimen in two portions (B) labeled "V 6362-6193. *Pheretima lauta*. Consul Siemssen 1/d. China, Futschau"; 1 clitellate specimen (C) from a tube labeled "*Pheretima* (Ph.) *siemsseni* Mich. Originale. China, Futschau. Consul Siemssen leg."; 1 softened clitellate specimen (D) labeled "V 7728. *Pheretima fokiensis* Mich. Orig. China, Prov. Fukien. G. Siemssen. 1.d"; 1 a clitellate and 4 clitellate specimens (E) labeled "V 351. *Pheretima löhri* Mich. China, Prov. Hupei." From the U. S. National Museum: 1 softened clitellate specimen (F) from a tube labeled "Foochow, China. C. R. Kellogg, collector." From Dr. Graham (several specimens referred to collectively as G): 6 specimens labeled "Mupin, 3,500-5,000 feet, July 1, 1929"; 5 specimens labeled "Suifu, 1,400 feet, April 18, 1925"; 1 specimen labeled "Near Hai-Tang, 6,000-8,000 feet, August 14, 1928"; 1 specimen labeled "Uingin-shien, 2,500-7,000 feet, July 14-15, 1928"; 1 specimen labeled "38 miles east of Tatsienlu on the Kong River, 1,500 feet, June 20, 1923"; 2 specimens labeled "Tatsienlu, 12,000 feet, July 7-9, 1923; and (several specimens referred to collectively as H) 1 specimen labeled "South of Suifu, 1,000-1,500 feet, March 25-29, 1930"; 1 specimen labeled "Kang-shien, 1,300-3,000 feet, October 28-29, 1928"; 1 specimen labeled "Fu-Lin, 3,000 feet, July 18, 1928"; 2 specimens labeled "Between Taso-Jia-Geo and Tsang . . . ? (remainder illegible), 1,500-3,000 feet, Sept. 3-4, 1929"; 2 specimens labeled "Suifu, September 1924";

1 specimen labeled "Suifu, water specimens, May 24, 1928"; 1 specimen labeled "Suifu." From the U. S. National Museum: 2 clitellate specimens (I) labeled "*Pheretima corrugata* Chen (paratypes), Kia-Ting, Szechwan. Y. Chen."

*External characteristics.*—Length, 33–36 mm (E), 125 mm (G), 85–120 mm (H). Diameter, 2 mm (E), 4–6½ mm (G), 2½–6 mm (H).

The setae begin on ii, on which segment there is a complete circle. A midventral gap, when present, is slight, a middorsal gap present or lacking. The setae of ii–ix, at least ventrally, are enlarged. Enlarged setae from several specimens (including a paratype of *P. corrugata*) have been examined microscopically. The shaft is almost straight, the ectal tip ornamented with short, transverse rows of very fine spines. The setal numbers are as follows:

viii	xvii	xviii	xix	xx	Specimens
25	28	21	27	ca. 70	A
24	24	20	23	ca. 65	B
17	26	16	26	-----	C
26	24	21	23	ca. 65	D
19	-----	15	-----	-----	E
18	19	15	21	-----	
17	-----	14	-----	-----	
24	23	20	24	-----	F
16	16	13	16	46	
16	17	13	19	58	
18	15	15	19	62	
15	19	13	19	-----	G
14	17	14	19	49	
17	17	13	18	56	
15	15	13	14	50	
17	17	12	17	54	
16	17	13	16	46	
18	20	15	18	60	
17	17	15	18	56	
16	19	13	21	57	
16	18	13	19	62	
14	16	10	16	-----	H
16	23	15	22	-----	
20	17	13	19	60	
<sup>1</sup> 16	17	15	19	69	
22	21	16	20	66	
22	19	15	20	60	
21	18	16	18	67	
22	20	15	20	64	
25	19	15	20	68	
24	19	14	19	-----	
19	21	16	22	-----	I
18	-----	16	-----	-----	
22	21	15	19	72	
<sup>2</sup> 16	21	15	20	-----	
15	17	14	21	-----	

<sup>1</sup> Wide ventral break with setal pits, if pits are counted as setae the number is 22.

<sup>2</sup> The epidermis damaged midventrally, the number possibly should be increased by 2 or 3.

The first dorsal pore is on 11/12 (31 specimens) but on two worms there are porelike but apparently nonfunctional markings on 10/11.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking; setae lacking except on three specimens, on each of which there are a few setae ventrally on xvi, a few further setae ventrally on xiv-xv on one specimen. The pores on 13/14 and 16/17 are functional.

The spermathecal pores are minute, widely separated, two pairs on 7/8-8/9, often on tiny, glistening, translucent tubercles. On specimens H the pores may be recognizable and apparently normal or abnormal in appearance or unrecognizable.

Each minute and superficial male pore is at or near the center of a small tubercle of circular to transversely elliptical outline, the tubercle surrounded by several concentric furrows, which are also circular or elliptical. On specimens A, B, C, D, and F the male pore is on the median portion of the male pore tubercle and on the lateral portion of the tubercle there is a gland pore or pores.

In the specimens H and I the male pores are invaginate, the apertures of the invaginations transversely slitlike, the invaginations slight. The slit is surrounded by a circumferential, elliptical lip, which is marked off on its outer margin by a groove also elliptical in outline. Beyond this groove there are 2-3-4 additional, similar, concentric grooves. The aperture of the male invagination may be closed or may gape open so that the interior is visible. In specimens I the lumen of the invagination is nearly filled by a transverse row of two tiny rounded tubercles, each with a pore on the ventral face. In most of the other specimens in place of these two papillae there is a low, transverse ridge, anteroposteriorly compressed and more or less bladeliike. The lateral portion of this ridge usually widens as it passes dorsally more noticeably than does the median portion. On the lateral portion of the ridges there is usually recognizable a marking that contains the site of the male pore, but the marking does not have quite the appearance of a normal male porophore. On the ventral face of the median portion of the ridge another more or less definitely demarcated marking may be visible.

In the setal circle of xviii (specimens E), separated by 14 or 15 setae are two transversely oval, flat areas, each of which is surrounded by two or three concentric and rather elliptical furrows. The innermost of the concentric furrows is the deepest, but there is no indication of the presence of a copulatory chamber or parietal invagination. The cuticle adheres tenaciously to the male pore areas and can be removed only by scraping. Although the scraping was done as gently as possible the surface of the areas was more or less damaged, so that pores are not definitely recognizable. The presence

of a stalked gland just median to the ectal end of the prostatic duct indicates that two pores should be present on each area—a median gland pore and a lateral male pore.

The genital markings are small, about 1 intersetal interval wide transversely; circular to transversely oval; each marking with a depressed, grayish-translucent center and an opaque, whitish, protuberant rim. Each of the midventral markings on xviii may be surrounded by 2 or 3 concentric circular furrows.

Presumably the grayish-translucent appearance of the central portion of a marking is the result of the crowding closely together of a number of pores, each of which has the appearance of a black dot. The recognition of distinct pores is exceedingly difficult except when the specimens are softened.

Just median to the male pore tubercles (specimens G) there are genital markings of similar shape and size. These markings are on the area crossed by the concentric furrows and are usually located between two consecutive furrows. On eight specimens there are two markings near each male pore tubercle, one presetal and one postsetal. On three specimens presetal markings alone are present on xviii. On two specimens one of the postsetal markings is lacking. On another specimen there are two extra presetal markings on the left side and one extra presetal marking on the right side. On another specimen there is an extra presetal marking on one side but on the other side the male pore region has an appearance very similar to if not exactly the same as that in *corrugata*. In this worm the prostate is lacking on the side having the *corrugata* appearance. On another specimen there are two extra presetal markings on one side; on the other side of xviii there are only two markings, in contact, both slightly sunk in a transverse depression, the male pore on the lateral marking.

The preclitellar genital markings are similar to the postclitellar markings and are usually close to or in the near vicinity of the spermathecal pores; on the posterior margins of vii and viii and the anterior margins of viii and ix; the markings immediately behind, in front of or slightly median to the spermathecal pores.

Genital markings are usually entirely lacking on the H and I specimens. One small specimen has a tiny, protuberant, and well-developed genital marking immediately behind each spermathecal pore. Another specimen has two pairs of tiny genital markings; presetal on viii and ix, each marking nearer to the midventral line than to the spermathecal pore, the markings of a pair separated by an interval about equal to 2–3 intersetal distances.

Genital markings of the other specimens are located as follows:

(A) On xviii: 4 presetal markings; one just median to each male pore tubercle and two near the midventral line, each marking just in front of *b*. On viii and ix, four pairs, presetal; one marking immediately posterior to each spermathecal-pore tubercle and another marking about 1 intersetal interval median to each spermathecal-pore tubercle.

(B) On xviii: 4 presetal markings located as on specimens A. On viii and ix; four pairs of presetal markings as on A and an additional marking, postsetal on ix, on the left side and in line with the presetal, median marking.

(C) On xviii: 4 markings; two just median to each male pore tubercle, one marking presetal and one postsetal. On vii and viii: 4 postsetal markings, one marking immediately anterior to (or anterior and very slightly median to) each spermathecal pore; and two presetal markings on viii, the markings slightly median to the spermathecal pores on 7/8.

(D) On xviii: 4 presetal markings located as on A. On viii and ix, four presetal markings: one marking about  $1\frac{1}{2}$  intersetal intervals median to the approximate site of each spermathecal pore. At the center of one of these markings there are visible six distinct minute pores. Originally there was a genital marking immediately behind each spermathecal pore, but the spermathecal pore tubercles and the associated markings had been removed in the previous dissection.

(E) The genital markings are tiny transversely oval areas on viii and ix; each area with a depressed center and a definite protuberant rim, less than 1 intersetal interval in width, slightly nearer to the intersegmental furrows than to the setae; one marking a trifle posterior to each spermathecal pore.

(F) Three presetal genital markings on xviii; one just median to each male pore tubercle and one just to the left of the midventral line, close to the setae and about in *ab*. On viii and ix there are four pairs of presetal markings as on A. On the grayish centers of each of the more median markings 6-9 pores are recognizable.

*Internal anatomy.*—(The internal organs had been removed from the anterior end of A, D, and two clitellate specimens of E or disarranged in previous dissections.) Septa 5/6-7/8 are thickly muscular; 8/9-9/10 lacking or 8/9 represented only by a ventral rudiment; 10/11-12/13 thickly muscular; 13/14 slightly strengthened.

On the esophagus just behind the gizzard there is either a lobed glandular collar or a rather slight ridgelike rudiment of the collar. The intestine begins in xv (21 specimens), with 15/16 (1 specimen), or in xvi (1 specimen). The intestinal caeca are simple, the ventral

margins incised in such a way as to mark off several rounded and stumpy or short, fingerlike lobes. Rarely there are also a few incisions of the dorsal margin. The typhlosole, a bladelike ridge, begins in the caecal segment.

There is a pair of hearts belonging to ix in 4 specimens; a single heart on the right side in 8 specimens, on the left side in 10 specimens. The last pair of hearts is in xiii (26 specimens). All hearts of ix-xiii pass into the ventral blood vessel. The hearts of x may be bound to the anterior face of 10/11 by connective tissue so that they are not readily recognizable.

The testis sacs of x and xi are unpaired and ventral (7 specimens), probably paired and ventral—no transverse connections between testicular masses of a segment recognizable (3 specimens, including one of the E specimens). The seminal vesicles may be small or medium-sized and vertical bodies, or large and in contact dorsally above the dorsal blood vessel, filling their segments. Primary ampullae may or may not be recognizable and when present may be more or less conical, protuberant, or sunk in a deep cleft in the dorsal margin of the ventral lamina, or merely demarcated from the ventral lamina by a circumferential constriction.

The spermathecal duct is stoutish, slightly bulbous toward the parietes, shorter than the ampulla, an ental portion usually invaginated into the ampulla. The diverticulum may be longer or shorter than the combined lengths of duct and ampulla. The diverticular stalk, which passes into the duct close to the parietes, is slender and glistening, nearly straight or bent entally into one to three tiny loops, the latter open or with the limbs in contact. The thicker but thin-walled seminal chamber, which is usually clearly marked off from the stalk, is elongate-ovoidal to ellipsoidal, approximately spheroidal, or somewhat pear-shaped. In the latter case the seminal chamber is not clearly marked off from the stalk. In specimen E the diverticulum is nearly three times as long as the combined lengths of duct and ampulla.

In segment xviii of specimens A-D and F the number of stalked glands is equal to the number of genital markings, including the male pore tubercles in the category of genital markings. Anteriorly the number of discrete glands may be less than the number of genital markings. Thus on the right side of segment ix in each of two specimens (A and B) two glands are enclosed in a common, connective tissue sheath; the entalmost portions of the stalks of the glands joined; passing ventrally toward the parietes the two stalks diverge, one passing to the genital marking immediately behind the spermathecal-pore tubercle, the other passing to the more median genital marking. (Also in viii and the left side of ix in specimen F.) A

similar condition is shown by Perrier in his pl. 4 (1872), fig. 68, where the stalk of the gland bifurcates near the parietes. "En arrière de ces deux premiers organes se voit une petite masse glandulaire, supportée par deux pédoncules." (See also Perrier's figure showing the genital markings.)

In specimens G there is a fairly conspicuous stalked gland projecting into the coelomic cavity dorsal to each genital marking, but a stalked gland to the male pore tubercle has not been noted. In specimens H there are stalked glands to the preclitellar genital markings when the latter are present. There may be a tiny stalked gland visible in the coelomic cavity near each prostatic duct. In some specimens a rudimentary gland may be found within the musculature in the vicinity of the prostatic duct. In other specimens, especially those in which the median portion of the ridge in the male parietal invagination is most compressed, no traces of glands or stalks were found.

*Remarks.*—There is some internal evidence to indicate that specimen C may be abnormal, but specimens A, B, D, and F appear to be normal.

Specimens G are certainly abnormal. Only one specimen has well-developed prostates (extending through xvii–xxi) and prostatic ducts (6 mm long, a middle portion thickly muscular). Each of 10 specimens lacks a prostate on one side, the prostate of the other side small and restricted to xviii. The prostatic ducts are present, even in absence of the prostates but are usually straight, the length varying from 3 to 6 mm. Other abnormalities have been noted in these worms especially in connection with the male deferent ducts. Two worms each have a pair of well-developed funnels in xii and a pair of seminal vesicles in xiii. No testes were found in xii in these specimens, but one has hypertrophied ovaries. In three worms the seminal vesicles are unusually large but are filled with parasitic masses. Each of two specimens has one male genital area that approximates more or less closely the condition characteristic of *corrugata*.

Specimens H are also almost certainly abnormal. The testis sacs of x and xi, which may be unpaired or paired, have little or no testicular coagulum but may be filled by the hypertrophied and undischarged testes and the male funnels. The seminal vesicles of x and xi are usually small, each vesicle provided with a primary ampulla, which is constricted off from the ventral lamina but not sunk therein, the ampulla often of about the same size as or only slightly smaller than the ventral lamina. In one small specimen, however (85 by  $2\frac{1}{2}$  mm), with genital markings, the seminal vesicles are large (relatively), in contact transversely over the dorsal blood

vessel, the primary ampullae small, more or less spheroidal and sunk into the dorsal margins of the ventral parts of the vesicles.

In one specimen the vasa pass posteriorly in the usual fashion, but the canal is unusually fine in part and nonexistent or at least unrecognizable in part. In another specimen each vas of a side can be traced from the prostate anteriorly to xv in a normal fashion. In the latter segment (on each side) the vas bifurcates into two discrete portions, which are separate through xiv and xiii. At the posterior face of 12/13 the separated portions again come into contact and then project through 12/13 slightly into xii. The terminus of the combined deferent ducts (of a side) in xii is club-shaped and firm. There are paired male funnels in the testis sacs of x and xi but no deferent ducts pass posteriorly from these funnels.

The spermathecal diverticula may not be differentiated into stalk and diverticulum, or the ental portion of the diverticulum may be widened but without the thin wall and large lumen of the seminal chamber. In only one specimen is there iridescent material in the seminal chambers. In this worm (the specimen with genital markings and large seminal vesicles) the elongated ellipsoidal seminal chamber is definitely marked off from a shorter stalk, but the spermathecal ducts are very short, almost rudimentary. The seminal chambers of other worms are filled with grayish or pinkish translucent material or a watery fluid.

It is unfortunate that so few normal specimens of *P. robusta* have been available for study. Specimens G, however, from Szechwan, in spite of their abnormalities, can be referred with but little doubt to *robusta*. Specimens H from Szechwan, also abnormal, presented a greater difficulty because of the invaginate male pores. On finding two specimens that would otherwise have been referred to *robusta*, characterized by a male pore invagination (on one side only) of the *corrugata* type it seems necessary to regard worms H also as abnormal specimens of *robusta* though even more abnormal than specimens G. In this case the abnormality (invagination of the male pores) is such that it would ordinarily be considered not as an abnormality but as good evidence for specific distinctness.

The types of *P. löhri* must have been allowed to dry out at some time almost completely. The specimens are very hard, brittle, shrunken, wrinkled, and stuck together, the body wall transparent. After soaking in water for several days, followed by a very slight drying, it was possible to recognize under best optical conditions the genital markings and apertures. The internal organs of the undissected type are brittle, adherent to each other and to the membranes and the body wall. Nothing could be found, however, after careful examination of the internal organs to indicate that these specimens



are other than abnormally dwarfed individuals of *robusta*. In the acitellate specimen and visible through the body wall are fairly large cysts, some of which are filled with pseudonavicellae spores. Possibly a heavy parasitic infestation during a juvenile stage was responsible for the dwarfing.

Ude's figure of a spermatheca (1932, p. 154, fig. 10) can scarcely be regarded as an illustration of any of the spermathecae (all of which are present) in the specimen of *P. lauta* now referred to *P. robusta*. The figure does show a condition that characterizes a single spermatheca of the holotype of *P. lauta* (= *P. aspergillum*). The spermatheca is abnormal, the seminal chamber swollen and distended by a transparent, watery fluid.

*P. robusta* is close to *P. aspergillum* from which it may be distinguished by the definitely smaller number of genital markings in the immediate vicinity of each male pore.

#### PHERETIMA SCHMARDAE (Horst)

1883. *Megascolex schmardae* HORST, Notes Leyden Mus., vol. 5, p. 194 (type locality: "Japan"; type in the Leyden Museum).  
1892. *Perichaeta sumatrana* BEDDARD, Proc. Zool. Soc. London, 1892, p. 155 (Hongkong).  
1899. *Perichaeta schmardae* var. *macrochaeta* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 12, p. 227 (Kowloon near Hongkong).  
1927. *Pheretima schmardae* MICHAELSEN, Boll. Lab. Zool. Portici, vol. 21, p. 84 (Macao).  
1931. *Pheretima capensis* (part) + *P. schmardae* MICHAELSEN, Lingnan Sci. Journ., vol. 8, pp. 158, 160 (excluding from *capensis* all except *sumatrana* Beddard, 1892).  
1931. *Pheretima* (*Ph.*) *schmardae* + *P. quadragenaria* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, p. 2.  
1931. *Pheretima* (*Ph.*) *schmardae* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 125 (Szechwan).  
1933. *Pheretima schmardae* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 277 (Chekiang and Hupei).

*Material examined*.—From the Hamburg Museum: 11 very soft clitellate specimens labeled "*Pheretima* (*Ph.*) *schmardae* Horst var. *Macrochaeta* (Mich.). China. Hongkong, Kowloon, Kraff l.d." From Dr. Graham: 1 clitellate specimen labeled "Suifu"; 3 clitellate specimens labeled "Between Kiating and Yachow, July 8-11, 1928."

*External characteristics*.—Length, 52-80 mm. Diameter, 2-4 mm.

The setae begin on ii, on which segment there is a complete circle. Some of the ventral setae of segments ii-v, vi, or vii are slightly enlarged. Posteriorly the setae are more closely spaced ventrally and laterally than dorsally. A midventral break in the setal circle when present is slight, usually lacking. A middorsal break of varying width is usually present. Setal numbers of the Szechwan specimens are as follows:

viii	xvii	xviii	xix	xx
29		15		
<sup>1</sup> 19	16	16	16	
26	17	<sup>1</sup> 9	17	47
31	22	16	22	53

<sup>1</sup> Indicates that there are gaps in the setal row where setae have probably fallen out.

On the Hamburg worms: viii/27–30, xviii/10–18.

The first dorsal pore (Szechwan specimens) is on 11/12 (1 specimen), on 12/13 (3 specimens). On the Hamburg specimens the first dorsal pore is either on 11/12 or 12/13.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking; setae present ventrally on xiv and xvi, possibly also on xv on some specimens.

The spermathecal apertures are minute, widely separated, on tiny transversely oval tubercles; two pairs, on 7/8–8/9. The spermathecal pore tubercles may be slightly protuberant or slightly depressed, in the latter case the appearance is superficially that of a transversely slitlike aperture to a spermathecal chamber.

The apertures of the copulatory chambers are round or transversely slitlike, the margins finely wrinkled. Each minute male pore is located on a small, smooth-surfaced, ovoidal to conical tubercle, which projects into the copulatory chamber lumen from the center of the dorsal wall.

*Internal anatomy.*—Septum 7/8 is thickly muscular or at least thicker than 5/6–6/7; 8/9–9/10 lacking.

The intestine begins in xv (8 specimens). The intestinal caeca are compound, glove-shaped, the dorsalmost secondary caecum the longest. The secondary caeca (4–9) are elongate, fingerlike, anteriorly directed, the length decreasing passing ventrally. On the esophagus just behind the gizzard is a low glandular collar.

Hearts of segment x were not found in any of the specimens. The single heart of ix is on the right side (4 specimens) or on the left side (4 specimens). The last pair of hearts is in xiii (8 specimens). All hearts of ix, xi–xiii pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles of xi and xii are fairly large, filling their segments and reaching into contact transversely over the dorsal blood vessels. Each vesicle is provided with a fairly large, more or less conical primary ampulla, the base of which is deeply constricted off from but sunk into the dorsal margin of the ventral lamina. The prostates extend through xvii–xx or xxi. The prostatic duct is  $2\frac{1}{2}$ – $4\frac{1}{2}$  mm long. The entalmost portion of the duct, about 1 mm in length, is very slender.

The ectalmost portion of the duct, which passes into the center of the dorsal face of the copulatory chamber, is also slender but is firm, smooth, and glistening. This portion of the duct is covered over by connective tissue—on first opening the worm only the middle portion of the duct is visible. The thick part of the duct may be straight or bent into a C-shape. The copulatory chambers are large and project conspicuously into the coelomic cavity. The wall of a chamber is rather thick, so that the lumen is small. On the anterior as well as on the posterior face of each copulatory chamber is an ovoidal glandular mass. From each mass a short stalk passes to a thin-walled sac. The latter opens into the lumen of the copulatory chamber by a rather large pore. Within each sac is a single, circular, flat or convex genital marking to which the stalk of the gland can be traced.

The spermathecal duct is shorter than the ampulla, abruptly narrowed within the parietes ectal to the diverticular junction. When the spermathecal duct is carefully pulled out from the parietes after separating the longitudinal muscle fibers the tiny papilla on which the spermathecal pore is located is removed. The spermathecal duct does not appear to be clearly marked off from the ampulla, but this appearance is due to the fact that the ectal portion of the ampulla is pushed down around and bound to the ental end of the duct by connective tissue. If this tissue is cut and the ectal margin of the ampulla pushed up, the duct has a bulbous or almost spheroidal appearance. The stalk of the diverticulum is longer than the spermathecal duct and may be straight or closely and shortly zigzag-looped in an ental portion. The wider seminal chamber may be straight or also looped.

*Remarks.*—The Hamburg specimens are soft and in very poor condition. As a result of the post-mortem changes the tissues have been gelatinized into a very sticky condition; the body wall is transparent and the internal organs are gummed together. In this condition little of value can be noted with regard to the external characteristics or internal anatomy. Two specimens were completely ruined by attempting to study them while moist. Four other specimens were pinned out on boards and opened carefully by a middorsal incision. The worms were then allowed to dry slowly for an hour in a warm room. At the end of that time the tissues had dried out so that it was possible to separate the organs and manipulate the septa and other membranes and even to work out accurately the characteristics of the testis sacs. The setal numbers and the characteristics of the genital markings and male pore areas are the only points of importance that could not be satisfactorily studied on these dried specimens. Except for the characteristics just mentioned the Kowloon and the Szechwan specimens are alike.

No trace of the hearts of *x* was found nor any "commissural vessels" belonging to *x*. The asymmetrical pair that Chen (1931, p. 129) refers to *x* probably represents the commissures of *ix*.

There is also some confusion in Chen's account (1931) with regard to the copulatory chamber and its glandular appendages and especially the thin-walled sacs into which the glands open. Thus, on page 127 there are said to be "Two shallow pits on anterior and posterior sides of the chamber in which the lateral glands open," while on page 130 each lateral lobe is said to be connected by small cords with a "small pit at the lateral side of the chamber." There is no variation with respect to this character in any of the eight specimens dissected, the glands and the chambers to which their ducts pass being anterior and posterior, never lateral and median.

Beddard's *sumatrana*, 1892, is, in all probability, either *californica* or *schmardae*. The presence of large copulatory chambers rules out *californica*. Similarly, compound intestinal caeca would rule out *schmardae* were it not for the fact that all but the dorsalmost secondary caeca may be overlooked unless the gut (in a specimen dissected from the dorsal side as is usual) is rolled well over to one side or the other. The dorsalmost secondary caecum, failing this precaution, would then appear to be a simple caecum.

#### PHERETIMA SZECHUANENSIS Chen

1931. *Pheretima* (*Ph*) *szechuanensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 160 (type locality: Mount Tsing-Chen, Szechwan; type in the Museum of the Science Society of China).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Suifu, 1,200–2,000 feet, October 1–November 1, 1928"; 2 clitellate specimens labeled "Suifu"; 3 clitellate specimens labeled "Near Haitaing, 6,000–8,000 feet, August 14, 1928"; 2 clitellate specimens labeled "Du Chiao, July 11–13, 1930."

*External characteristics*.—Length, 80–115 mm. Diameter,  $3\frac{1}{2}$  mm.

The setae begin on *ii*, on which segment there is a complete circle (with the exception of one specimen on which the dorsal setae are lacking from *ii*–*vi*). The ventral setae of *ii*–*ix* are enlarged, diminishing in size passing from *a* laterally. Setae *a*–*c* of these segments are nearly straight, with tips ornamented by transverse, infrequently broken rows of fine spines. A middorsal break of variable width is present in the setal circles, a midventral break slight or lacking. The setal numbers are as follows:

vi	vii	xvi	xvii	xix	xx	First dorsal pore
-----	17	18	16	21	-----	11/12
-----	-----	15	17	17	43	11/12
19	20	27	21	26	-----	11/12
12	13	24	18	25	52	<sup>2</sup> 5/6
14	15	18	18	21	56	<sup>2</sup> 5/6
14	15	13	11	15	-----	11/12
16	17	15	13	16	46	11/12

<sup>1</sup> Gaps present.

<sup>2</sup> See on dorsal pores below.

The first dorsal pore is on 11/12 (5 specimens). On two specimens there are porelike markings on 5/6–10/11. When the worms are bent the coelomic fluid oozes to the exterior through these pores (?), but the openings into the body cavity of the coelomic face of the parietes do not have quite the appearance of normal pores.

The clitellum is annular, extending from 13/14 to 16/17; dorsal pores and intersegmental furrows lacking; setae probably lacking on most of the specimens, but a few scattered setae present ventrally on xvi of one specimen.

The spermathecal apertures are minute, widely separated, on tiny tubercles on 6/7–8/9.

The male apertures are minute; in 5 specimens each pore is at the center of a small transversely oval tubercle. On one specimen each male pore is at the center of a very narrow elongate marking, extending anteroposteriorly nearly to 17/18 and 18/19. On the remaining specimens the male pores are on tiny pointed protuberances.

The genital markings are two pairs, each marking transversely oval, slightly larger than the oval male-pore tubercle, the center of each marking about in line with the male pore, one marking just in front of and another just behind the male-pore tubercle, an anterior or a posterior margin of a marking in contact with the tubercle (4 worms). On another specimen there are six pairs of these markings, one pair postsetal on xvii, another presetal on xviii and in addition an unpaired marking, two pairs postsetal on xviii, another presetal on xix, and one postsetal on xix. On the worm with elongated male-pore areas there is a pair of elongated genital markings, each with bluntly rounded ends, slightly crescentic in appearance with the concave side facing mesially, reaching anteroposteriorly to 17/18 and 18/19. On the remaining worms there are on xviii two pairs of genital markings, one presetal and one postsetal. The anterior, elongate-oval markings are just lateral to the male pores and extend anteriorly to 17/18 and posteriorly to just behind the setae. The posterior markings are smaller, almost circular, immediately behind the male pores.

*Internal anatomy.*—Septa 5/6–7/8 are thickened; 8/9 membranous but complete, bulged posteriorly into a funnel-shape by the gizzard; 10/11 membranous and apparently complete (1 specimen) present ventrally only in others and unrecognizable in the remainder; 11/12–12/13 membranous but slightly strengthened.

The origin of the intestine is variable. In one specimen the thick-walled, narrow, esophageal portion of the gut is continued into xxvi, the thin-walled, grayish, wider intestinal portion of the gut beginning abruptly with 26/27. In other specimens there is a more gradual transition from the esophageal to the intestinal portion of the gut, an abrupt widening such as is often present in xv, entirely lacking. The intestinal caeca are compound, glove-shaped, each caecum with 7–12 elongate, fingerlike, secondary caeca. The ventral-most secondary caecum is the longest, the dorsal-most the shortest.

The single heart of ix is on the left side (5 specimens) or on the right side (1 specimen). The last pair of hearts is in xiii. The hearts of ix–xiii all pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles are large, in contact transversely over the dorsal blood vessel. The prostates extend through xvii–xxi but may push 16/17 and 15/16 anteriorly. The prostatic duct is 7–10 mm long, bent into a hairpin loop, the ectal limb much thicker than the ental limb.

The spermathecal duct is stout, glistening, shorter than the ampulla, gradually narrowed in the parietes. The diverticulum passes into the anterior face of the duct close to or actually within the parietes and is composed of a slender, smooth, glistening, stalk portion with a narrow lumen and an ovoidal, spheroidal, or elongate-tubular, thin-walled, seminal chamber. The elongate-tubular seminal chamber was found only in a worm very heavily parasitized by coelomic Protozoa.

In the parietes in the vicinity of the ectal end of the prostate ducts there are glandular masses.

*Remarks.*—Three specimens were badly mutilated, each broken (though not quite through) in two places, one just anterior to the clitellum and one just posterior to the clitellum. A fourth specimen has several spiral abnormalities in the anterior region. The remaining specimens, as well as some of those just mentioned, are heavily parasitized by coelomic Protozoa and/or nematodes. In one of the unbroken specimens the reproductive organs are very poorly preserved, in particular the seminal vesicles and the testis sacs.

In this latter specimen the seminal vesicles of xi have the appearance of being contained within outgrowths of a testis sac, but the preservation is too poor to permit an exact determination of the rela-

tionships. In at least two specimens the presence of unpaired testis sacs has been definitely determined. In one specimen in which septum 10/11 is recognizable only in its ventral portion, the part on which the testis sac of x is located is invaginated into xi, while the portion of 11/12 on which the testis sac of xi is located is invaginated into xii. In one of the broken specimens the seminal vesicles of xi appear to extend anteriorly at the sides of the gizzard.

The only important difference between the account above and that of Chen is in the number of spermathecal setae on viii, 13-20 on the U. S. National Museum specimens, 22-30 on Chen's worms. Some of Chen's specimens are larger and longer than the National Museum specimens and have a slightly more extensive clitellum.

The genital markings are variable as regards number, location, shape, and size.

#### PHERETIMA TSCHILIENSIS Michaelsen

1903. *Pheretima asiatica* MICHAELSEN, Mitt. Naturhist. Mus. Hamburg, vol. 19, p. 11 (part) (Tibet).  
 1928. *Pheretima tschiliensis* MICHAELSEN, Arkiv för Zool, vol. 20, no. 2, p. 13 (type locality: 50 Chinese miles east of Hsuan-Hua-Hsien, Chihli; types in the Stockholm Museum).  
 1930. *Pheretima kiangsuensis* CHEN, Sci. Rep. Nat. Cent. Univ. Nanking, ser. B, vol. 1, p. 24 (type locality: ?; types ? Nanking and Soochow).  
 1931. *Pheretima asiatica* (part) + *P. tschiliensis* MICHAELSEN, Lingnan Sci. Journ., vol. 8, pp. 158, 160 (including part of or all the Tibetan forms of *asiatica*).  
 1931. *Pheretima* (Ph.) *tschiliensis* + *P. tibetana* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 2, 13 (type locality of *tibetana*: River Dracu, Tibet; types in the Hamburg Museum).  
 1931. *Pheretima tibetana* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 61, p. 568.  
 1931. *Pheretima* (Ph.) *kiangsuensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 7, p. 119 (Szechwan; specimens in the Museum of the Science Society of China).  
 1933. *Pheretima tschiliensis* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 250 (Kiangsu, Chekiang, and Anhwei).  
 1935. *Pheretima tschiliensis* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 16.

#### THE FOLLOWING DOUBTFULLY PLACED IN SYNONYMY:

1933. *Pheretima yamadai* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 255 (forms with simple intestinal caeca).

*Material examined*.—From the Hamburg Museum: 2 softened specimens (A) labeled "V 10579. *Pheretima tschiliensis* Mich. China, Prov. Chihli. Pro. Anderson leg. Michaelsen ded. 50 chin. Meilen östlich von Hsuan Hua Hsien"; 3 specimens (B) labeled "V 5890. *Pheretima asiatica* (Michlsn) Tibet. Koznakov Dracu" and "jetzt *Pheretima tibetana* Mich." From the U. S. National

Museum: 1 specimen (C) labeled "*Pheretima tschiliensis* (Mich.), Szechwan, China. Ident. by Y. Chen." From Dr. Graham: 1 clitellate specimen labeled "Near Mupin, 3,500–5,000 feet, July 1, 1929"; 1 clitellate specimen labeled "Near Kangshien, 1,400–1,800 feet, August 28, 1929"; 2 clitellate specimens labeled "Near Mupin, 1,300 feet, July 7, 1929"; 2 clitellate specimens labeled "Near Mupin, 7,000–13,000 feet, July 8, 1929"; 1 clitellate specimen labeled "Between Ningyuenfu and Den Shiang Uin, 6,000–8,100 feet, August 6–18, 1928"; 1 clitellate specimen "Chin-Chi-Shien, 3,500 feet, July 17, 1928"; 3 clitellate specimens labeled "Shin Kai Si at Mt. Omei, August 7–9, 1929"; 3 clitellate specimens labeled "South of Suifu on the Yunnan border, 6,000 feet, April 25, 1929 (secured by aboriginal collector for Dr. Graham)"; 1 a clitellate specimen labeled "Near Song Pan, 7,000–8,000 feet, July 12–13, 1924"; 1 a clitellate specimen labeled "Near Luting Kiao, 6,000 feet, August 9, 1923"; 1 a clitellate specimen labeled "Between Gin Keo Ho and Dawei, 1,300–5,000 feet, August 1–2"; 2 clitellate specimens labeled "Tatsienlu, 8,300 feet, July 16, 1930." Also 1 a clitellate specimen and 2 clitellate specimens (D) with no data.

*External characteristics.*—Length (of clitellate specimens only), 110–330 mm. Diameter, 6–13 mm. A grayish-blue to brownish pigmentation of the dorsum is recognizable on recent specimens; no pigmentation visible on older specimens.

The setae begin on ii, on which segment there is a complete circle. The setal circles are usually unbroken midventrally; rarely midventral gaps on a few of the postclitellar segments; slight midventral gaps on the preclitellar segments (1 specimen). The middorsal gaps, often lacking, are variable in width when present. The ventral setae of the preclitellar segments are slightly enlarged. The setal numbers are as follows:



vii	viii	xvii	xviii	xix	xx	Remarks
18	16	13	15	14	52	
17	19	16	15	17	63	
23	22	18	14	18	52	
16	16	16	12	13	54	
23	22	15	14	17	58	
25	27	18	13	20	63	
18	19	21	14	18		
19	20	16	13	17	63	
21	22	19	13	13	63	
20	19	20	10	17	67	(1).
22	23	14	11	17	57	(1).
26	25	15	* 8	14	83	(1).
24	26	31	28	28	* 80	(2).
22	23	25	18	* 29		Specimen C.
21	21	25	14	24		
20	* 18	24	13	25		Specimens A.
22	24	18	14	19		Immature (?).
22	21	19	14	19		Do.
19	20	21	19	22		Do.
25	24		14			
23	24					
23	25					Specimens B. <sup>3</sup>
26	25	16	* 2	16	67	
22	20	16	* 10	19		Specimens D.
22	20	18	11	19		

<sup>1</sup> Specimen with large numbers of parasitic bodies visible externally.

<sup>2</sup> Gaps in setal circle indicate that some setae have been lost.

<sup>3</sup> Large numbers of parasites in the coelomic cavities, the parasites not visible externally.

<sup>4</sup> Ventral setae of xix and some of the succeeding segments abnormally placed, possibly zigzagged; the setal row apparently doubled in spots.

The clitellum is annular, extending from 13/14 to 16/17. Inter-segmental furrows and dorsal pores are lacking. Setae are usually lacking; on Chen's specimen there are circular rows of setal pits on xi-xvi but no setae are visible; on four specimens there are a few setae midventrally on xvi. The dorsal pores on 13/14 and 16/17 are functional.

The spermathecal pores are minute, widely separated; three pairs, on 6/7-8/9. Each pore is at the center of a tiny, circular to transversely oval, smooth area the margins of which are usually not clearly demarcated. The spermathecal pores are readily recognizable though minute owing to the presence of a tiny whitish rim around the margin of a pore. A spermathecal pore tubercle may be very slightly depressed into the body wall.

The apertures of the male-pore invaginations, are crescent-shaped, the concave side of the crescent facing midventrally. The apertures of softened specimens gape open so that a portion of the median wall of the invagination is visible. The lateral wall of the invagination is thin and without setae; the ventral margin of this wall forming a crescentic, lateral lip of the aperture of the invagination. On one specimen the invaginations are almost completely everted.

On the median wall of the invagination there is a lobulated ridge, which bears 2-6 setae. The minute male pore is on a smooth glistening porophore in the dorsalmost portion of the invagination. The shape of the porophore varies. In a majority of the specimens the porophore is an elongated, lateromesially compressed ridge, the ventral surface sloping dorsally toward the anterior and posterior ends. The portion of the ridge on which the male pore is located may be protuberant as a tiny knob. The porophores are shortened anteroposteriorly in one specimen, diagonally placed in another, almost transverse in another. In another specimen the porophores are shortened and more protuberant, rather conical, and somewhat penis-like in appearance. The genital markings on the median wall of the invagination are variable as to size, number, and location:

- I. One small, transversely oval, protuberant, presetal disk; the central portion grayish and translucent; the margin opaque and whitish. 5 specimens.
- II. Two oval disks, one presetal and one postsetal. 1 specimen.
- III. As in I but the disk hypertrophied, about 6 intersetal intervals wide transversely; the median ridge dislocated posteriorly, crowded against the posterior wall and apparently without setae. 3 specimens.
- IV. A transversely oval presetal disk as in I and in additional one or more circular markings as in V.
- V. Genital markings tiny, circular in outline, usually protuberant. Two presetal markings, 1 specimen. Two presetal and two postsetal markings, 2 specimens (on one of these specimens the latter markings unusually deep in the invagination and in contact with the male porophore) One presetal and one postsetal marking, 1 specimen.

The apertures of the male pore invaginations of specimens D gape open widely. On the median wall of the invagination is a large, presetal, transversely oval genital marking that is 4-5 intersetal intervals wide transversely. In the clitellate specimens this marking has grown posteriorly through the region on which the ridge should be located. Setae appear to be lacking in the invaginations of the clitellate specimens. The male porophore is in the dorsalmost portion of the invagination and varies from a shortly conical penislike tubercle with a bluntly rounded ventral end to an elongate lateromesially compressed ridge. On the median wall of the invagination between the oval tubercle and the male porophore there is, in each of the specimens, a smooth, glistening, tripartite, butterfly-shaped area. The middle portion representing the body is slightly more protuberant than the presetal or postsetal portions that represent the spread wings. On the acitellate specimen the male porophores, the butterfly-shaped areas, and the oval disks are delimited, but the parietal invagination is represented only by a slight crescentic

groove the horns of which pass mesially just beyond the butterfly marking. Just lateral to the groove is a tiny rudiment of the crescentic lip of the adult invagination.

Just behind each spermathecal pore there is usually a genital marking. This marking may be transversely oval or crescentic and with the concave margin in contact with or near to the posterior margin of the spermathecal pore tubercle. The crescentic markings may be quite protuberant and constricted slightly so as to produce a stalked appearance. In place of or in addition to the markings just mentioned there may be small circular genital markings, each of which as well as the previous markings has a grayish, translucent, central portion and an opaque rim. The extra markings may be on the anteriormost margins or vii-ix, the posteriormost margins of vi-viii (rarely) or nearer to the setae than to intersegmental furrows; one marking just in front of a spermathecal pore or just median to a spermathecal pore or 2-5 intersetal intervals median to a spermathecal pore. Preclitellar genital markings are lacking on specimens D.

*Internal anatomy.*—Septa 5/6-7/8 are thickly muscular; 8/9-9/10 lacking; some or all of septa 10/11-13/14 thickly muscular.

On the esophagus just behind the gizzard there is visible in many of the specimens a slight glandular collar. The intestine begins in xv (15 specimens); in one specimen the gut slender through segments xv-xvii, widening gradually in xviii-xx. The intestinal caeca are simple; the ventral margins incised, the depth of the incisions variable, usually deeper posteriorly and less readily visible or lacking anteriorly.

A pair of commissures belonging to ix is present in three specimens, in two of which one commissure is quite definitely smaller than the other; a single commissure on the left side of ix (6 specimens), on the right side (4 specimens). The last pair of hearts is in xiii (16 specimens). The hearts of x are fairly large but are more or less closely bound to the anterior face of 10/11. All hearts of ix-xiii pass into the ventral vessel.

The testis sacs of x and xi are unpaired and ventral; the anterior sac with a bilobed ventral margin. The seminal vesicles are fairly large, filling segments xi and xii and in contact transversely above the dorsal blood vessel. Usually each vesicle is provided with a primary ampulla, the base of which may be more or less deeply sunk into the dorsal margin of the ventral lamina. In some of the specimens there are paired, stalked pseudovesicles in xiii. The prostates extend through some or all of segments xvi-xx. The prostatic ducts are 6-20 mm long, bent into hairpin-shaped loops, the ectal limb of each loop much thicker than the ental limb.

The spermathecal duct is stoutish, usually slightly shorter than the ampulla from which it is more or less clearly demarcated. Near the parietes the duct is swollen and has a more or less strongly marked, bulbous appearance. Removal of the longitudinal musculature discloses in the parietes a rather thick, firm column. This column is usually removed when the spermathecal duct is pulled out from the parietes, the spermathecal pore tubercle on the ventral face of the column. When the spermathecal duct is pulled out from the parietes of softened specimens the column is not removed, but a very slender, conical portion of the spermathecal duct is pulled out from the center of the column. At the end of the conical portion of the duct is the spermathecal pore surrounded by the tiny whitish ring of tissue previously mentioned. In this case a circular hole with a smooth margin is left in the spermathecal pore tubercle. The diverticulum passes into the median face of the duct close to the parietes and comprises a smooth, glistening stalk with a narrow lumen and a thin-walled seminal chamber with a wider lumen. The seminal chamber is usually looped back and forth in a regularly zigzag fashion; the limbs of the loops are short and in apposition but may be straight or nearly so, twisted variously or loosely and irregularly looped. The diverticulum (in the looped condition) is about as long as or longer than the combined lengths of duct and ampulla. The length of the diverticular stalk varies considerably.

In the parietes just behind each spermathecal duct there is usually visible a mass of glandular tissue slightly protuberant into the coelomic cavity and forming a sort of U-shaped half-collar on the posterior face of the ectal end of the spermathecal duct. Some of the stalks or ducts from this glandular mass may be firmly attached to the duct but do not appear to pass into the duct. In xviii, on the parietes, anterior or median or posterior to the ectal end of the prostatic duct there is usually visible glandular tissue in one or more discrete masses with ducts passing to the genital markings in the male pore invagination. The glandular masses are usually flattened and not conspicuously protuberant into the coelomic cavity.

*Remarks.*—A number of the specimens, including the largest worm (330 by 13 mm) and the types of *P. tibetana*, are heavily parasitized. Some of these parasitized worms are obviously abnormal. Possibly the abnormalities have developed as a result of the parasitic infection. Among the abnormalities noted are the following: Rudimentary spermathecae, spermathecal duct unusually long (much longer than the ampulla), seminal chamber very loosely looped or with but one or two loops or practically straight. Possibly the absence of genital markings in some of the parasitized specimens and some of the

rather unusual variation in the setal numbers are also to be explained as the result of parasitic infection.

So many of the specimens are parasitized or show evidence of previous infestation or are abnormal that the determination of the normal range of variation of important characteristics has not been possible. Whenever normal specimens are available the variation in the setal numbers and the location and numbers of the genital markings should be recorded.

The male parietal invaginations of *P. tschiliensis* are very similar to those of *P. praepinguis*. The two species are distinguished from each other by characteristics of structures at the ectal end of the spermathecal ducts. There is evidence to indicate that the development of the spermathecal apparatus may be affected in various ways as the result of the presence in the worms of large numbers of parasites. If the parasitic influence is able to inhibit the development of the spermathecal pore invaginations in *P. praepinguis*, such abnormal specimens may be very difficult to distinguish from *P. tschiliensis*.

Specimens of *P. tibetana* (= *P. tschiliensis*) were originally regarded as conspecific with the Tientsin specimens of *P. asiatica* (Michaelsen, 1903, p. 11). The distinctions that Michaelsen later made between *P. asiatica* and *P. tibetana* do not appear to be of importance.

Specimens of *P. asiatica* have not been available for examination. The species is inadequately characterized. *P. tibetana* and *P. asiatica* may be synonymous as Michaelsen originally thought, or *asiatica* may be a synonym of *P. guillelmi*.

#### PHERETIMA TUBERCULATA Gates

1935. *Pheretima tuberculata* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 18 (type locality: Suifu, Szechwan; types in the U. S. National Museum).  
1936. *Pheretima tuberculata* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 11, p. 302 (after examination of type).

*Material examined*.—From Dr. Graham: 1 clitellate specimen labeled "Suifu, 1,000 feet, April–May 1925"; 1 partially clitellate specimen and 3 clitellate specimens labeled "Suifu, 1929"; 1 a clitellate specimen and 1 clitellate specimen labeled "Mupin, 3,500–5,000 feet, July 1, 1929."

*External characteristics*.—Length, 80–110 mm. Diameter, 3–5 mm.

The setae begin on ii, on which segment there is a complete circle. A midventral gap in the setal circle is usually lacking, when present slight; a middorsal gap also usually lacking, when present variable though never very wide. The setal numbers are as follows:

vi	vii	xvii	xviii	xix	xx	First dorsal pore
10	11	17	10	19	41	10/11
9	10	18	12	18	40	<sup>1</sup> 10/11
9	9	17	12	17	40	<sup>1</sup> 11/12
10	10	16	11	18	-----	10/11
10	14	17	12	18	51	10/11
10	13	19	13	19	53	10/11
10	10	17	12	20	-----	10/11

<sup>1</sup> A porelike marking on 9/10 or 10/11.

The first dorsal pore is usually on 10/11.

The clitellum is annular, extending from 13/14 nearly to 16/17; intersegmental furrows and dorsal pores lacking; no setae visible. On two specimens the clitellum does not reach to 13/14.

The spermathecal pores are minute, widely separated; three pairs on 5/6-7/8.

The male pores are minute, each pore at the center of a very small, indistinctly demarcated, oval area in the setal circle of xviii. On this male pore area there are several tiny, slightly protuberant, circular tubercles. There are usually two of these tubercles just median to the male pore, one presetal and one postsetal, and a third lateral to the male pore and either presetal or postsetal. In addition there may be 1-3 further tubercles crowded in between the male pore and the lateral or median tubercles.

Anterior to each spermathecal pore and on the posteriormost margin of the segment is a tiny circular tubercle at the center of which there is a pore or porelike depression. This pore may be mistaken for a spermathecal pore: it is often much easier to see than the spermathecal pore. The spermathecal pore can be distinguished by its posterior location and recognized by the very delicate iridescence of the margin of the pore, an appearance that is entirely lacking around the pore of the tubercle. (If the spermathecal duct is carefully pulled out from the body wall the spermathecal pore is removed but not the tubercle.) Four specimens have no further genital markings. A fifth specimen has a pair of tubercles on viii, presetal in position, nearer to the setae than to the intersegmental furrow and to the midventral line than to the spermathecal pore, while on the left side of vii and in line with the left tubercle of viii there is a single presetal tubercle.

A sixth specimen has a pair of tubercles on xviii close to the midventral line and to the intersegmental furrow 17/18 and a single tubercle on xix close to 18/19 and just to the left of the midventral line. This specimen also has a single presetal tubercle on viii close to the midventral line and the setae. Another specimen, which is

not included in the account above but which probably belongs to this species, has several spiral abnormalities on the anterior segments. On this worm there are paired presetal tubercles on vi-vii or v-vi, depending on which side one counts the intersegmental furrows. (On this same specimen the male-pore area on which the tubercles are seated is clearly marked off by a slight but evident circumferential furrow.)

*Internal anatomy.*—None of the septa are thickly muscular, though 5/6-7/8 and some or all of 10/11-12/13 are strengthened and with muscular fibres; 8/9-9/10 lacking.

The intestine begins in xv. The intestinal caeca are compound, glove-shaped, with 3-5 fingerlike, anteriorly directed, secondary diverticula. The dorsalmost diverticulum is the longest, and attached to its ventral margin are 3-6 anteriorly or ventrally directed tertiary diverticula.

There is a pair of hearts belonging to ix (1 specimen), a single heart on the right side (2 specimens) or on the left side (2 specimens). The last pair of hearts is in xiii (5 specimens). All hearts of ix-xiii pass into the ventral blood vessel. The hearts of x are held by connective tissue against 10/11.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles are fairly large, filling segments xi and xii, those of a segment in contact transversely over the dorsal blood vessel. The prostates extend through xvii-xxi or xxii. The prostatic duct is 2-3 mm long, softish, a middle portion thicker than the rest, bent into an S- or W-shape or almost straight. There is a pair of rudimentary pseudovesicles on the posterior face of 12/13 and a still smaller pair on the posterior face of 13/14, each pseudovesicle club-shaped.

The spermathecal duct is short, narrowed gradually in the parietes, and not sharply demarcated from the longer ampulla. The diverticulum, which passes into the median face of the duct close to the parietes, is longer than the combined lengths of duct and ampulla and comprises a slender, smooth and glistening, firm stalk, which is longer than the spermathecal duct, and a thinner-walled ental portion, which is looped in a regularly zigzag fashion with the loops short and all in the same plane. The diverticulum may be almost straight with a slight suggestion of a spheroidal seminal chamber at the ental end.

Connected with each tubercle or genital marking is a stalked gland, the gland spheroidal to ovoidal, usually quite small, the stalk much longer, smooth, glistening and tough, erect in the coelomic cavity. The stalks of the glands passing to the tubercles just in front of the spermathecal pores may be much shortened and very slender or about the same size and length as those of the other tubercles.

*Remarks.*—*P. tuberculata* is distinguished from sexthecal Chinese species of *Pheretima* with spermathecal pores on 5/6–7/8 by the compound, glove-shaped, intestinal caeca.

Chen (1936, p. 303) gives a figure of an intestinal caecum that appears to be only the dorsalmost secondary caecum.

**PHERETIMA VULGARIS** Chen

1930. *Pheretima vulgaris* CHEN, Sci. Rep. Nat. Centr. Univ. Nanking, ser. B, vol. 1, p. 12 (part) (type locality: ?; types: ?; excluding forms with male pores in parietal invaginations).  
 1931. *Pheretima kiangensis* MICHAELSEN, Zool. Jahrb. (Abt. Syst.), vol. 61, p. 558 (part) (excluding quadrithecal forms with superficial spermathecal pores; Soochow).  
 1931. *Pheretima* (*Ph.*) *kiangensis* MICHAELSEN, Peking Nat. Hist. Bull., vol. 5, pt. 3, pp. 3, 21 (part) (excluding quadrithecal forms with superficial spermathecal pores).  
 1933. *Pheretima guillelmi* CHEN, Contr. Biol. Lab. Sci. Soc. China, zool. ser., vol. 9, p. 249 (part) (excluding synonymy and distribution of forms with male pores in parietal invaginations).  
 1933. *Pheretima vulgaris* FANG, Sinensia, vol. 3, no. 7, p. 179 (part) (specimens from Ichang).  
 1935. *Pheretima vulgaris* GATES, Smithsonian Misc. Coll., vol. 93, no. 3, p. 19.

*Material examined.*—From the Hamburg Museum: 6 clitellate specimens from a tube labeled "*Pheretima pingi* Steph. Soochow Biol. station leg."; 1 acitellate specimen labeled "*Pheretima* (*Ph.*) *kiangensis* Mich. (= *Ph. kiangsuensis* Chen). China. Soochow Biol. station, Soochow."

*External characteristics.*—Length, to 220 mm. Diameter, to 8 mm.

The setae begin on ii, on which segment there is a complete circle. The setae are small, closely and regularly spaced. The setal numbers are as follows:

vii	viii	xvii	xviii	xix	xx
26	26	17	15	20	64
21	21	19	12	18	65
28	28	27	17	24	78
23	24	19	14	19	76
21	20	18	12	16	-----
19	21	15	11	15	<sup>1</sup> 66
14	14	18	17	19	(?)

<sup>1</sup> Acitellate specimen.

<sup>2</sup> Abnormal specimen.

The first dorsal pore is on 12/13, but on two specimens there is a nonfunctional porelike marking on 11/12.

The clitellum is annular, extending from 13/14 to 16/17; intersegmental furrows lacking; functional dorsal pores present on one specimen, nonfunctional rudiments of dorsal pores visible on an-



other specimen; setae apparently lacking on four specimens, although setal pits may be visible ventrally, setae present ventrally on xiv (1 seta) and xvi (6 setae) on one specimen.

The secondary spermathecal apertures are wide slits; three pairs, on 6/7-8/9. Each pore is 2-3 intersetal intervals wide transversely. The anterior margin of the pore is slightly protuberant and minutely lobulated. The posterior margin may or may not be protuberant and lobulated.

One of the specimens has a pair of female pores on xiv instead of a single pore.

The apertures of the copulatory chambers are longitudinal slits, the median margin of the slit minutely lobulated, the lateral margin smooth and firm. The copulatory chambers of four of the specimens are everted as conspicuously protuberant club-shaped bodies, thickest ventrally, narrowing gradually passing dorsally. The narrow neck, a short portion almost at the level of the ventrum, is firm, smooth, or with several very slight circumferential furrows. Ventral to the neck portion the protuberance is softer, and the surface is cross-hatched by numerous furrows. On the posterior face, close to the neck, is a single genital marking, circular or oval. On the flat ventral surface is a crescentic groove or slit, its concave side facing mesially. The slit opens into a lumen, which is crescentic in section and which extends within the protuberance nearly to or slightly into the neck. On the median wall of this lumen there are three markings, two oval, one circular. One of the oval markings is flat, without a raised margin and with a tiny, whitish, conical protuberance, at the pointed end of which is the minute male pore. A peripheral portion of each of the other markings is slightly raised and rimlike, and on this rim is a fine groove or furrow, circular or oval in outline according to the shape of the marking. There is no groove on the male pore area. Presumably the copulatory chambers are only partially everted. Complete eversion then would obliterate the lumen and bring the markings therein onto the ventral face of the porophore.

There are no external genital markings.

*Internal anatomy.*—Septa 5/6-7/8 are muscular; 8/9 represented by a membranous ventral rudiment; 9/10 lacking; 10/11-12/13 muscular; 13/14-14/15 strengthened but translucent.

There is a glandular collar of grayish, finely granular appearance on the esophagus just behind the gizzard. The intestine begins in xv (4 specimens). The intestinal caeca are simple; without marginal incisions in one specimen, slightly constricted by the septa in three specimens, with numerous lobulations of the ventral margin in the abnormal specimen. The typhlosole begins just behind the caeca.

The single heart of ix is on the left side (2 specimens) or the right side (3 specimens). The hearts of x are large and filled with blood. The last pair of hearts is in xiii (4 specimens). All hearts of ix-xiii pass into the ventral blood vessel.

The testis sac of x is U-shaped. The dorsal ends of the limbs of the U reach to or nearly to the dorsal blood vessel. The testicular coagulum within the sac apparently reaches dorsally in only one specimen. However, when the sacs of the other three specimens were cut open a thin layer of testicular coagulum was found on the anterior face of each heart. The testis sac of xi is also U-shaped in three specimens, the hearts and seminal vesicles of xi contained within the limbs of the sac, the vesicles and hearts embedded in testicular coagulum. In the fourth specimen the dorsal ends of the limbs of the U have fused above the gut so that a portion of the dorsal blood vessel is within the sac and surrounded by testicular coagulum. The testis sac of xi in this specimen is accordingly annular.

The seminal vesicles of xii are in contact transversely above the dorsal blood vessel. No primary ampullae are recognizable on the vesicles of xii, but each vesicle of xi is provided with a definite, more or less conical ampulla.

The prostates extend through some or all of segments xvii-xxi, each prostate cut up into 15-25 or more elongate-fingerlike lobes. The prostatic duct is 6-8 mm long, bent into a hairpin loop, the ectal limb of the loop much thicker than the ental limb. In three specimens the prostatic duct passes directly into the parietes, and there is no trace whatever within the coelomic cavity of copulatory chambers. In the retracted condition the copulatory chambers are club-shaped, narrowed ectally, but this is not at first evident as each chamber is bent over onto the parietes laterally while portions of the chamber are covered over by muscular bands, connective tissue, and glandular masses. The prostatic duct passes into the mesial face of the chamber near the ental end, but this also is obvious only after removal of connective tissue. The tracing of the prostatic duct and the gland stalks through the neck of the everted chamber to the markings is easy, as there is little connective tissue. The glands connected with circular genital markings are smaller than those connected with oval markings.

The coelomic portion of the spermathecal duct is pinkish, short, thick, rather bulbous, and with a smooth surface. The diverticulum passes into the median face of the duct. Ectal to this junction the duct is narrowed, the slender portion within the lateral wall of the spermathecal chamber. The diverticular stalk is always longer than the coelomic portion of the spermathecal duct and like the latter

is firm, smooth, and pinkish. The seminal chamber is elongate and looped, the looping usually (completely or in part) of a short, regularly zigzagged type. The spermathecal chamber projects conspicuously into the coelomic cavity, but the junction of the chamber and the bulbous portion of the spermathecal duct is covered over by connective tissue so that the chamber at first appears to be merely a thicker ventral portion of the duct. The chamber does not, however, have the smooth pinkish appearance of the bulbous portion of the duct. Within the chamber are two or three genital markings, round or oval and similar to those in the copulatory chamber. The wall is cross-hatched by furrows producing a warty appearance very similar to that within the copulatory chambers. The minute, primary spermathecal pore is located at the apex of a tiny, glistening, conical protuberance. The margin of this protuberance is not definitely demarcated as is the margin of a genital marking. The stalks of the genital marking glands are not as a rule confined to the wall of the spermathecal chamber but project slightly from the surface of the chamber, holding the glands erect in the coelomic cavity. All spermathecal chambers of each specimen are completely retracted.

*Remarks.*—The acitellate specimen is 125 mm long; maximum diameter, nearly 4 mm. The clitellar segments are fully setigerous and without trace of clitellar glandularity. The spermathecal apertures are open and transversely oval; through each aperture a genital marking is visible, the marking in the lateral part of the spermathecal chamber. The partially everted copulatory chambers are as on the clitellate specimens except that there are two round genital markings in contact and near the neck. The genital markings, in the spermathecal as well as in the copulatory chambers, are fully developed and similar in appearance to those of clitellate specimens. The conical protuberance on which the minute spermathecal pore is located is not so large as in adult specimens. The male pore area is also not quite so large as in clitellate specimens, though the minute male pore is recognizable.

The seminal vesicles are approximately of adult size. The testis sacs are both U-shaped. The testicular coagulum extends in the sac of x only halfway up the limbs of the U. There is a very thin layer of testicular coagulum in the sac of xi partially surrounding each seminal vesicle. The prostates and prostatic ducts are nearly adult size. The spermathecal chambers are well developed and project conspicuously into the coelomic cavity. The spermathecal ducts are apparently fully formed. The ampullae are small and empty. The diverticula are probably also fully formed, but the seminal chambers are transparent. The glands on the spermathecal chambers and in the prostatic region are very small.

The account above (normal forms) differs somewhat from that of Chen, especially with respect to the copulatory chambers, testis sacs, and male deferent ducts. The everted copulatory chambers of the Hamburg specimens are club-shaped but with the narrowed portion of the everted body nearest the parietes, a reversal of the condition figured by Chen. The testis sacs of x and xi of the Hamburg specimens are U-shaped. Chen's description of the testis sacs is, however, not clear, so that an adequate basis for comparison is not available. In the Hamburg specimens the two male deferent ducts of a side come into contact in segment xii, whereas in Chen's specimens the vasa deferentia of a side pass posteriorly into xviii independently of each other. The differences just mentioned appear to be rather unimportant and insufficient justification for the erection of a new species, especially in view of the similarities of the copulatory and spermathecal chambers. The Hamburg specimens have accordingly been referred to *P. vulgaris*.

One of the specimens of "*pingi*" is abnormal but probably referable to *vulgaris*. The spermathecal pores are transverse, wide slits with slightly elevated and minutely lobulated anterior and posterior margins. The pores do not open into deep pits but into shallow depressions. One of these depressions is deeper than the others and contains a single circular genital marking. The minute primary spermathecal pores are not visible and could not be found by tracing the spermathecal duct through the parietes. The external spermathecal apertures are like those of *vulgaris* except that they do not open into deeply invaginated spermathecal chambers. The development of the chambers appears to have been suddenly stopped before the invagination extended through the body wall, or in the case of some of the pores before the invagination had penetrated to the level of the longitudinal muscle layer.

The male porophores are conspicuously protuberant and slenderly columnar bodies. There are one or two genital markings at the ventral end of a porophore, but the markings are very vaguely outlined and do not appear to be normal. The male pores were not found. There are several setae on the median face of each porophore.

The testis sacs of x and xi are unpaired and ventral, seminal vesicles of xi excluded. The left anterior vesicle is much firmer than the other vesicle and projects conspicuously into the gizzard segments through an oval aperture in 10/11 at the level of the dorsal blood vessel.

The spermathecal duct is rather slender, of about the same length as the ampulla, pinkish but rather soft. The diverticular stalk is about as long as the spermathecal duct or slightly shorter.

The single preclitellar stalked gland passes through the parietes to the genital marking previously mentioned. The glands in the prostatic region are rudimentary.

The abnormalities of this worm may have been brought about as the result of the presence of large numbers of parasites. In the postclitellar portion of the worm there are many gregarinoid cysts on the body wall, fairly regularly distributed throughout the whole of this portion of the worm. There are also a few cysts on the dorsal face of the gut. In addition, there are nematodes in the coelomic cavities, throughout the entire length of the worm.

Fang (1933, p. 179) refers three worms "apparently without clitellum" from Nan-hu to *P. vulgaris*. One of these specimens, labeled "*P. vulgaris* Chen. Ichang, Hupeh, 1929" has been available for examination. The specimen is quite obviously acitellate. The worm is characterized by large, club-shaped, copulatory chambers, a U-shaped testis sac belonging to x and spermathecal invaginations into the coelomic cavities as in *P. vulgaris*. Other sex organs are more or less rudimentary.

Fang also states that "some individuals collected from Peiping by Mr. C. J. Shen are referable to this species," i. e., *P. vulgaris*. Chen's species, however, comprised two distinct forms. Fang does not indicate which of these forms is involved, and accordingly the record from Peiping cannot be accepted.

**PHERETIMA species, 1**

*Material examined*.—From Dr. Graham: 2 acitellate specimens labeled "Mt. Omei, 6,000 feet, August 1922"; 2 acitellate specimens labeled "Shin Kao Si, Mt. Omei, 4,400 feet, August 25-26, 1924."

*External characteristics*.—Length, 242-357 mm. Diameter, 11-13 mm.

The setae begin on ii, on which segment there is a complete circle. There is no definite midventral gap in the setal circles; the middorsal gaps are of variable width. Setal numbers are as follows:

vii	viii	xvii	xviii	xix	xx
25	27	-----	30	-----	-----
25	28	-----	25	-----	-----
25	26	27-30	22	24-30	ca 83
23	26	-----	25	-----	-----

The first dorsal pore is on 11/12 (1 specimen) or 12/13 (3 specimens).

There is no indication of the development of clitellar glandularity on any of the specimens. A single female pore can be recognized on xiv on one specimen.

The spermathecal pores are minute, on tiny tubercles or areas of especial smoothness; three pairs on 6/7-8/9.

In the setal circle of xviii on each side there is visible a small transversely oval area. Each of these areas is demarcated laterally by a slight, rather crescentic furrow, the concave side of the crescent facing midventrally. Just lateral to this furrow on one specimen is a tiny rudiment of a crescentic lip. On the lateralmost portion of the oval area there is visible a minute rudiment of the male pore (confirmed by dissection). On each male pore area (1 specimen) there are visible with high magnification and brilliant illumination two tiny spots somewhat median to the male-pore rudiment. These spots appear to be the rudiments of genital markings. Just anterior to the lateralmost 2 or 3 male setae on each side is a transversely oval genital marking.

*Internal anatomy.*—Septum 4/5 is thin; 5/6–7/8 thickly muscular; 8/9–9/10 lacking; 10/11–13/14 muscular to thickly muscular; 14/15 slightly muscular; 15/16 and several succeeding septa are thickened but membranous.

The intestinal caeca are simple, extending from xxvii into xxi–xxiii; the ventral margins incised, the ventral lobes rounded or fingerlike but short and stumpy.

The testis sacs of x and xi are unpaired and ventral. The seminal vesicles of xi and xii are medium-sized, anteroposteriorly flattened, vertical bodies. In xiii there is a pair of fairly large pseudovesicles. The prostatic duct is 4–5 mm long, bent into a C- or U-shape. The duct is not narrowed prior to entrance into the parietes but on the contrary has a rather bulbous appearance in the dorsal portion of the body wall. While the longitudinal muscle fibers were being removed the prostatic duct was accidentally broken off. The broken ends are not irregular and jagged but smooth and regular. At the ventral end of the ental portion there is a deep, smooth-surfaced and glistening, cuplike socket. Attached to a middorsal point within the socket is a very slender but firm cord. The dorsal end of the ectal portion of the duct is also smooth and glistening, ball-shaped. At the center of the dorsal surface is a pore opening into a lumen from which the slender cord has been pulled out. The ectal portion of the duct narrows gradually in the outer portion of the body wall but can be readily traced for most of the distance, as it remains firm and has a smooth, glistening surface. The prostatic duct of the other side of the same worm was then broken off revealing a similar ball-and-socket joint.

The spermathecae are rudimentary, just projecting from the parietes into the coelomic cavity; the diverticulum, a slender, fingerlike body; duct and ampulla not differentiated. Pulling the spermatheca out of the parietes after separating the fibers of the longitudinal muscle layer leaves a rather wide, transversely oval aperture with a smooth margin in the epidermis.

*Remarks.*—Some of the preclitellar, ventral setae are enlarged and modified; 0.7–1.0 mm in length, the ectal tip ornamented with circles of very fine teeth.

In spite of their size the worms just described are not sufficiently mature to enable specific identification. The crescentic furrow and lateral lip at the margin of the male pore area probably represent an early stage in the formation of the type of male parietal invagination that characterizes *P. praepinguis*.

No preclitellar genital markings were observed in the first examination, but after completion of the study of the holotype of *P. praepinguis* the worms were reexamined and a tiny area of peculiar appearance was noted just anterior to each spermathecal pore. This area may possibly represent the rudiment of the genital marking on the anterior face of the spermathecal invagination of *praepinguis*.

One of the prostatic ducts of the type of *praepinguis* was purposely broken off by a quick jerk, thereby revealing a "joint" somewhat similar to that described above except that both ball-and-socket portions are more flattened out.

Numbers of parasites (nematodes and Protozoa) were found in the coelomic cavities of the two acclitellate specimens that were opened.

#### PHERETIMA species, 2

*Material examined.*—From the U. S. National Museum: 1 clitellate specimen labeled "*Pheretima szechuanensis* Chen, paratype, Y Chen."

*Remarks.*—On each male pore area of xviii are tiny rudiments of three markings, two of which are toward the median margin with one presetal and one postsetal, while the third is toward the lateral margin and probably represents the rudiment of a male pore disk. Just lateral to the male pore area is a rudiment of a lateral lip such as is associated with the type of parietal invagination found in *P. tschiliensis* and related forms.

The intestinal caeca are simple, long, and slender, with slight incisions of the ventral margin.

The spermathecae are rudimentary.

The worm is quite obviously not *P. szechuanensis*.

#### PHERETIMA species, 3

1927. *Perichaeta hupehensis* GEE, BORING, and WU, Lingnaam Agr. Rev., vol. 4, p. 1.

According to Gee, Boring, and Wu (1927), "the common Soochow worm," which they identified as "*Perichaeta hupehensis*," has two, three, or four pairs of spermathecal pores though the "normal number is three" on 6/7–8/9 (p. 1). The large apertures on xviii, which

are said to be "very evident after the worm has been killed" (p. 1), or "conspicuous slits" (p. 7) must be apertures of copulatory chambers or openings into parietal invaginations. These structures indicate that the "common Soochow worm" is probably not *P. hupeiensis*, a probability that becomes a certainty with the absence of septa 8/9-9/10. The variation in the number of spermathecal pores may be taken as an indication that the "Soochow worm" is possibly at least three distinct species, none of which can be referred to *hupeiensis*.

Two other points may be mentioned in connection with the paper by Gee, Boring, and Wu: (1) "In the Soochow *Perichaeta* the ventral vessel is double at the anterior end, from the posterior edge of the gizzard forward" (p. 5). Anterior to 10/11 the ventral blood vessel is often very slender, while the ventrolaterals (lateral esophageals) are large, distended with blood. These larger vessels have almost certainly been mistaken for bifurcations of the ventral trunk. (2) "A small species of *Lumbricus* also occurs in China and furnishes some interesting comparisons with the *Perichaeta*" (p. 4). Careful search of the literature has failed to reveal any record of the occurrence of *Lumbricus* in China. Presumably the generic name *Lumbricus* has been used as a convenient designation for any sort of a lumbricid worm. It is very unfortunate that Prof. Frank Smith's (1924) remarks on textbook earthworms versus real earthworms and Stephenson's comments on "the earthworm" and "the common earthworm" (1930, pp. x-xi) were not published where they would have commanded wider attention from zoologists.

#### PHERETIMA species, 4

1930. *Pheretima obscuritopora* CHEN, Sci. Rep. Nat. Centr. Univ. Nanking, ser. B, vol. 1, p. 28.

*P. obscuritopora* was erected by Chen for immature specimens on which no trace of clitellar glandularity was visible. So far as can be determined from the description, the types are not sufficiently developed to enable recognition of the specific characteristics. The spermathecae (see Chen's fig. 10, p. 36) certainly do not appear to have attained their definitive conformations. The condition figured is more or less closely approximated by very rudimentary spermathecae of ac clitellate specimens of *P. tschiliensis*. The "very small crescent shaped groove" can be interpreted as an early rudiment of the type of male pore invagination that characterizes *P. tschiliensis*. The types of *P. obscuritopora* were collected from the same localities as *P. kiangsuensis* (= *P. tschiliensis*) and may, quite possibly, be merely immature forms of that species.

Chen's Szechwan specimens of *P. obscuritopora* (see Chen, 1931) may or may not be conspecific with the Nanking and Soochow specimens.



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